American Machinist

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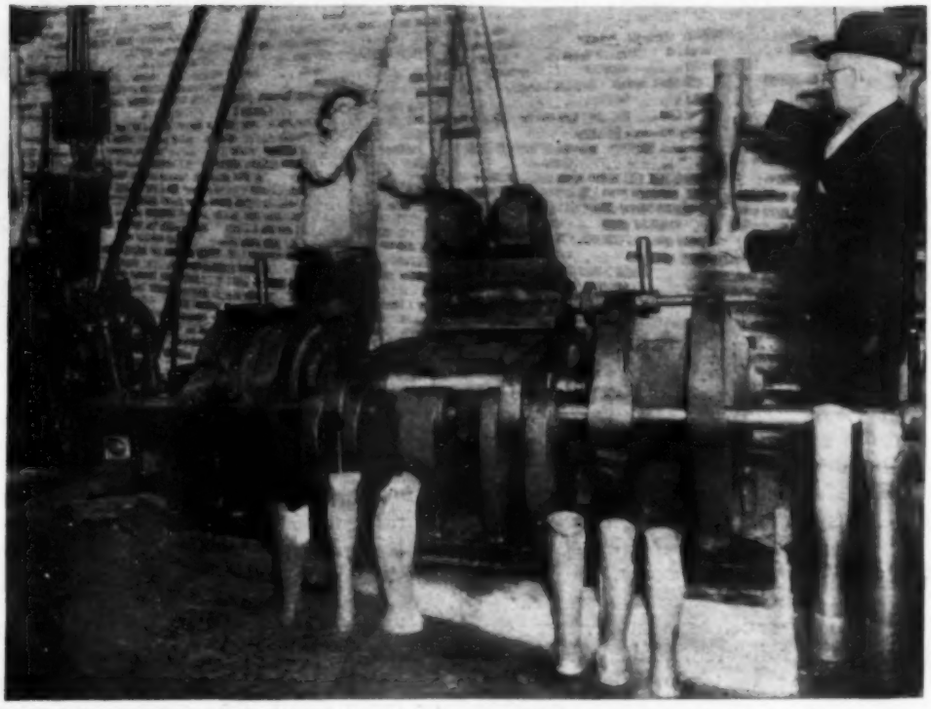
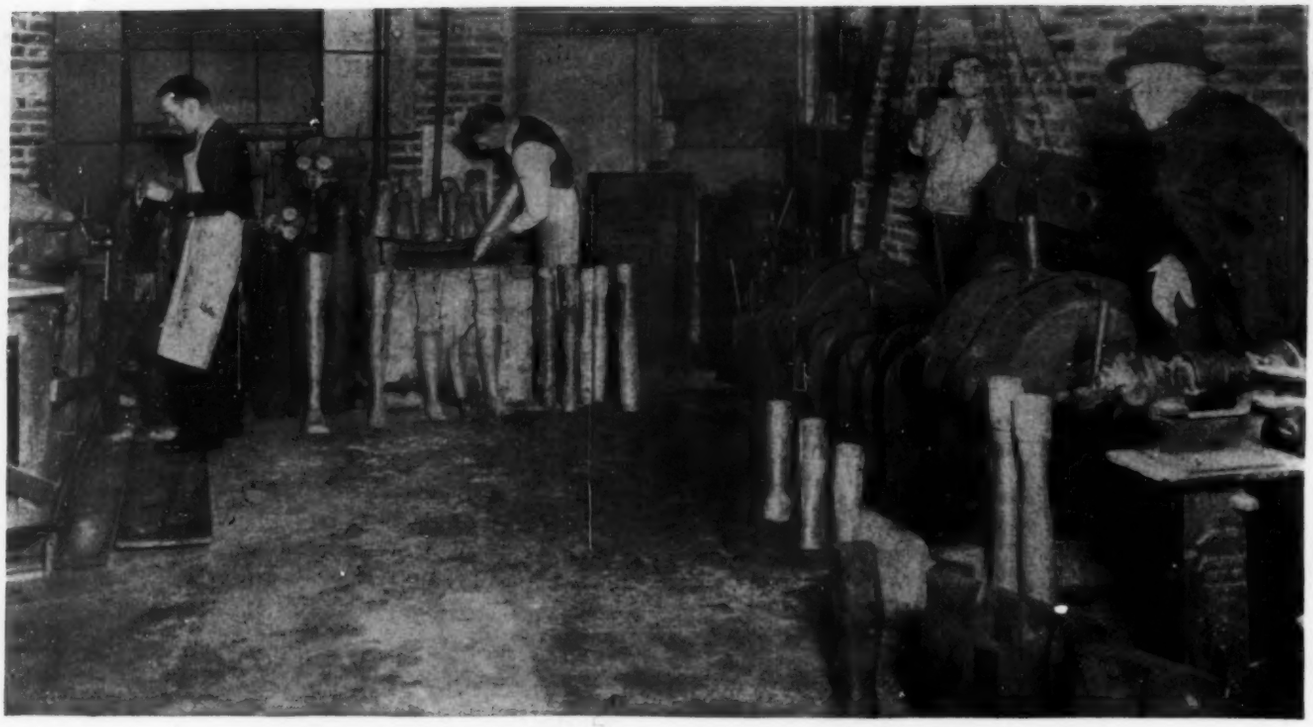


The new hydraulic press and its inventor exhibiting the unusual shape it forms

Hydraulic Forming Artificial Limbs

An adaptation of the common hydraulic press solved a difficult forming problem, provided a new use for seamless Duralumin-type tubing, improved a product, and reduced production time 98 per cent

EARLY in 1913, a British aviator lost his leg in an airplane crash at Hendon. The weight of the conventional wood artificial limb proved very annoying. It was fashioned by hand of leather, wood, and steel in the time-honored way, was clumsy, heavy, and since formed by hand to the stump, never fitted perfectly. Being a trained mechanical engineer with a knowledge of metallurgy in addition to his familiarity with the lighter metals incorporated in airplane construction, he, assisted by his brother, an aeronautical engineer, conceived the idea of forming a limb of aluminum alloy, thus attaining greater strength coupled with greater lightness. Following this lead, various European limb manufacturers took up the idea, and began manufacturing Duralumin limbs in a variety of ways. Most of these limbs were hand hammered to shape in halves, the halves being joined later by welding or riveting. It was of course an expensive process, since the hammered form had to be inverted, the dents taken out, and the final shaping done, all by hand. Further, in making the shin, the ankle could not be formed; thus riveted or welded joints appeared just above the ankle and up the front and back of the leg where they showed most. Later developments resulted in pressed shin halves, and one manufacturer even succeeded in pressing the entire leg shape, thus avoiding the front seam. These refinements in construc-



The corner of the shop devoted to the forming and metal-finishing operations

tion in France, England, Germany and Italy have resulted in the adoption there of some 100,000 metal limbs.

American limb builders, however, looked upon the metal leg with caution, for deliveries were slow and replacements and repairs introduced serious problems. Further, artificial limbs were standardized, hence did not match the wearer's other limb, fitted poorly, and had the telltale riveted or welded joints in exposed positions.

Charles H. Davies of Philadelphia, limb wearer for thirty years and limb builder for ten, conceived the idea of pressing the parts from seamless aluminum alloy tubing, and believed the hydraulic expanding press could be adapted to the work. Experiments, however, with various sizes of tubing resulted either in wrinkling at the ankle with larger tubing diameters, or splitting parallel to the "grain" of the tubing at the back of the calf when smaller diameters were used. The utter lack of symmetry of the human leg below the knee, coupled with the formation of the ankle and the necessity for matching the wearer's other leg, introduced all sorts of difficulties in expanding. Using a larger diameter tube and spinning it to an approximate leg shape was tried, but even this did not solve the difficulty entirely.

Experts of the Aluminum Company became interested in the problem, as did other limb manufacturers and a number of engineers. The expanding difficulties were discovered to result from the fact that one small section of the circumference at the calf was required to expand some 40 per cent of its own width in order to produce the normal calf to one side of the leg center line. Upon application of hydraulic pressure, three-quarters of the 13-in. tube circumference at the calf was pressed against the mold or die wall, while the remaining quarter did all the expanding.

It was finally discovered that dropping the machine head upon the spun tubing would "distort" the tubing almost enough to fill the die, and also so rearrange the metal that the subsequent expansion would occur evenly. The forming press was accordingly rearranged to incorporate this principle. The same cast-aluminum dies were used to perform the expanding operation and the stamping or "distorting" operation which precedes it. It was also found that the same machine could be used to form the knee and upper leg part for the full-length limb. The shop was accordingly changed over from a wood limb to a metal limb shop, principally by changing the driving motors on the machines, bandsaw blades, and replacing the sanding wheels by grinding wheels.

The machine employed for both forming and pressing is a 10-ton horizontal hydraulic press using only female or outer dies. This construction permits the forming of material of any wall-thickness desired. Pressure is applied simultaneously from both ends of the tubing, rams moving in conventionally to compensate for shortening of the tubing as expansion occurs. The lower die is bedded in the machine; the upper is set in a swinging head that can be tilted up and back by means of an electric hoist. Two clamping arms, one at either end of the upper die block, hold the tubing in position during the expansion. They mate with similar pieces cast integral with the bed, coming together around the hydraulic pistons or nozzles, and being adjusted for fit by cast semi-cylindrical shims. The nozzles have a shape generally similar to that of a grindstone and are adjustable along the fluid supply shaft on an external thread. Fluid for the expansion is admitted behind the nozzle, passing between it and a leather cup washer which the pressure expands against the interior of the tubing, thus sealing the joint. The fluid is permitted to enter the interior of the tubing through four small holes 90 deg. apart in the face of the nozzle, these holes being sufficiently small to maintain the pressure which locks the washer. One nozzle enters each end of the tubing, which is held tightly by the clamping arms and cast aluminum semi-cylindrical shims. The machine head is locked in the conventional way by bars pushed through holes in the end of the head support arm. A feature is an eccentric in the arm end which clamps the head down still more tightly when the

clamping bar is turned. The same bar locks the clamping arms.

Dies for the machine are cast of aluminum alloy by the Rolle Aluminum Casting Company, Philadelphia. Mr. Davies found that the differences in length of leg between knee and ankle occur principally at two points of almost uniform cross-section, one in the middle of the calf, the other about 1½ in. above the ankle. The dies were therefore designed for the longest shin that would be formed, plus sawing allowances, and eight ¼-in. shims cut out at each of these points. Filler blocks of corresponding thickness were made to fit the ends of the die in order that over-all length would remain unchanged no matter what combination of die elements are used. Elements are held together by the usual through pins. Thus the die, constant in over-all length, may be altered to make seventeen different sizes of shins. Dies for the knee and thigh sections are of similar construction, and the mandrells upon which tubing is spun previous to being expanded are also similarly designed. This of course introduces tremendous economies in die cost, since far fewer dies are required to form the necessary 204 different shapes and sizes of limb. For the smaller dies, such as are used for children's legs, a filler sleeve or subdie, semi-cylindrical in cross-section, is slipped between the die and holder. This permits further savings in material and in die weight.

At the beginning some difficulty was experienced in making dies which would allow the finished piece to be removed, because of the many irregular contours of the leg. This was solved by splitting the die slightly off center, although the ends are perfectly centered, as can be seen from the expanded blank that Mr. Davies is holding in one of the illustrations. Although these dies, with their sharp mating edges, are dropped on the tubing in the distortion previous to expansion, no appreciable wear has as yet occurred on the edges, nor on other parts of the die, for that matter. They appear in every way just as satisfactory as cast steel dies, with the added advantage of increased lightness, appreciated by employee limb wearers handling them.

The process of making a metal limb may be exemplified by the manufacture of the shin or lower limb section. A piece of Alcoa tubing of the necessary thickness is spun to the rough leg shape illustrated by the pieces at Mr. Davies' feet in the illustration previously referred to. The spun section is annealed at 650 deg. F. in a molten salt bath, quenched in water, packed with sand and wooden plugs inserted at each end. It is then placed in the die, the operator taking care that no danger of pinching the tubing is imminent. Clamping arms are locked to position on the tubing, the hydraulic plungers brought up to hold the wooden plugs in place, and the 2,000-lb. die holder of the machine brought over to a position about 10 in. above the die. The holder is rested on a small block and the electric hoist removed. Then a simple blow with a hammer kicks out the holding block and the heavy head drops on the blank to "distort" it to fit the die roughly. Experience has shown that one or two drops of the head cause the tubing to fit the die sufficiently closely so that the limb can be made to fit the die exactly in a single expansion, without danger of splitting or excessive thinning of any part of the cross-section. After a number of experiments, it was found that the aluminum alloy known as 51S works most successfully.

After "distortion" the sand is removed, the tubing placed over the nozzles, the machine closed and locked, and a hydraulic pressure of 2,500 lb. per sq.in. applied. This produces a part that fits the die perfectly, correct in alignment, exact in shape and length, without rivet or weld, a total weight of less than a pound, and a tensile strength of something over 60,000 lb. per sq.in. The shin, in particular, is perfect in shape from just below the knee to about 1 in. below the ankle, thus permitting the foot joint to be below the average low-shoe top. So accurate is the shape that no further shaping is required ordinarily, although for exceptionally large calves, the shin may be put on a hand roll and expanded still further at the calf. This perfect shaping is in answer to the American demand for an artificial limb permitting golf knickers or short skirts to be worn without it being evident that the wearer has an artificial limb.

The expanded part is again heat-treated, then finished by cutting off top and bottom in a rotary cutter, shaping the upper part of the calf, and inserting either the knee joint straps, or the socket if the limb is for a below-knee amputation. The knee and thigh parts for above-knee limbs are similarly fabricated in one piece.

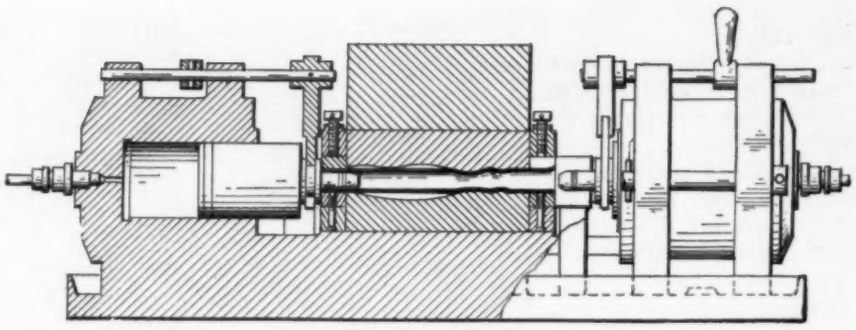
The Story Behind This Story

NOT often is it possible to find a story combining practical technical worth and the most intense human interest. But here is a description of the manufacture of artificial limbs from seamless Alcoa alloy tubing, and the story of its originator, Charles H. Davies, of Philadelphia, mechanical engineer, limb manufacturer for ten years, and himself a limb wearer for thirty. He lost his leg in a mine accident when he was eleven, but worked his way through Bucknell college by running a shell-turning lathe during the war. Shortly after, he began manufacturing artificial limbs, first of wood in the conventional way, later of various metals. Eventually he decided that the ideal limb was of Alcoa, an aluminum alloy, manufactured mechanically. His success in developing the process, attained through a combination of perseverance, mechanical ingenuity, and a desire to aid others similarly incapacitated, has also resulted in a number of interesting developments in metal forming by hydraulic means. These include the use of sectional cast aluminum alloy dies, drop pressing or "distortion," and hydraulic "blowing" or expanding with the same press and dies, plus the pressing of difficult irregular shapes from seamless Alcoa tubing.

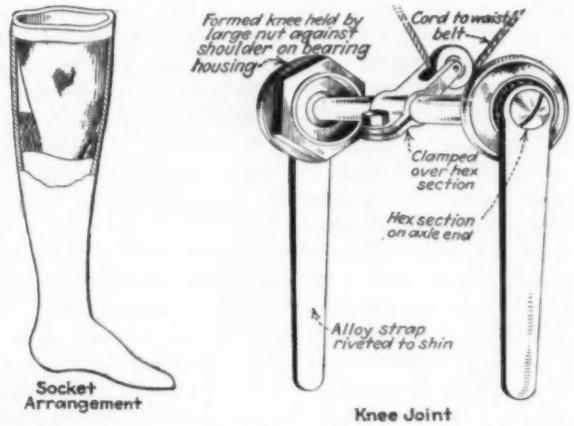
Our "tip-off" to the story is just as interesting. Several years ago, George L. Markland, Jr., of the Philadelphia Gear Works, vital, energetic, constantly and intensely active, lost a leg. The future seemed hopeless until Mr. Davies was called in. Climbing to the top of the hospital room radiator, Mr. Davies jumped first to Mr. Markland's bed, then to the floor, where he performed a few intricate jig steps and waltz gyrations—all with an artificial limb. He gave Mr. Markland new heart, and made him a new leg. For the past three years Mr. Markland, now chairman of the Philadelphia Gear Works, has been watching Mr. Davies experiment with hydraulic pressing of limbs and has himself suggested a number of the innovations which are incorporated in the recently perfected process. When Mr. Davies received his first patents a short while ago, Mr. Markland prevailed upon him to permit *American Machinist* to describe it. Immediately Mr. Markland wrote us, "Any metal-forming process that cuts production time from five weeks to five hours, cuts labor about 90 per cent and cost 50, is worth a story, even though the reduction in human suffering is not considered." We visited Mr. Davies; we agree absolutely with Mr. Markland, and we think you will, too, after you've read the story. Incidentally, in the reading you'll probably pick up pointers that will help solve your press problems.

Undesirable features of a limb thus fabricated were its metallic "feel," its tendency toward vibration and consequent undesirable noise, the possibility of its being dented, its lack of resistance to corrosion from perspiration, and its metallic, hence unnatural, finish. Various lacquers and varnishes were tried in an effort to secure a flesh color, without a great deal of success. Finally plastics were resorted to, but many of these were inflammable, hence highly undesirable —for the person with an artificial limb has no way of telling when it is too close to an open fire. Lumarith, a cellulose acetate molding material that is non-inflammable and easily formed, was tried. It was found that Lumarith tubing of flesh color —in fact of *any* flesh color desired, pink, white, red, yellow, or black—could be fitted uniformly and tightly over the metal form with a minimum of labor, and that it answered all the objections to the metal limb. It took out the ring, gave a proper color and feel, supplied necessary outside corrosion resistance, and in addition about doubled the resistance of the material to denting. Lumarith tubing of a diameter approximately that of the ankle is now dipped in hot water, expanded to a truncated cone, the limb section slipped in, the top edge of the plastic turned over, and the assembly allowed to cool. The Lumarith shrinks tightly in place and provides a permanent outer finish. The limb is then drilled with a number of small holes for ventilation, the inside of the tubing is sprayed with a corrosion-resisting paint, the socket and foot are fitted, and the leg is complete.

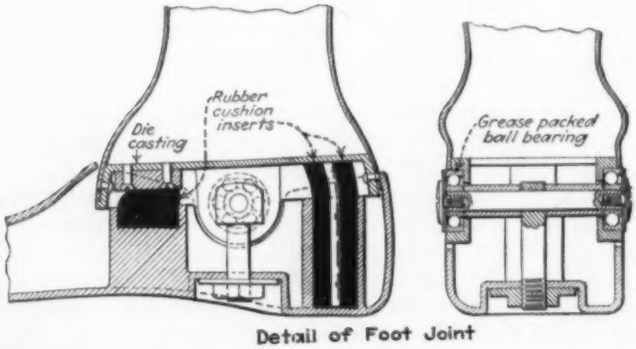
Since Lumarith worked so well as an outer covering, it was reasoned that it should work equally well for the socket. The sockets were formerly hand formed of wood or leather, and were of course good or bad fits, depending upon the state of the artisan's disposition on a particular day. Suffice it to say that few fitted perfectly. By the new process, however, a mold is made of the stump, a cast made in the mold, Lumarith shrunk over this cast, the cast cut out, and the socket, complete, corrosion-resistant, and a perfect fit, placed in the top of the limb. Further, at a later time when the stump shrinks with natural shrinkage of the muscles, the same process is simply repeated, the old Lumarith socket being reshrunk to the new cast. This avoids the former necessity of an entirely new fitting of the stump, loss of time, cost, and the other attendant difficulties. As a matter of fact, present experiments open up possibilities that limbs may eventually be formed entirely of plastic materials, except of course for the metallic working parts, which could be molded as inserts.



Diagrammatic cross-section of the press



Formed knee held by large nut against shoulder on bearing housing
Cord to waist belt
Clamped over hex section
Hex section on axle end
Alloy strap riveted to shin
Knee Joint



A number of other interesting fabrication details may only be mentioned here because of space limitations. Metal construction permits the incorporation of ball bearing joints at knee and ankle, and parts other than the knee, socket, thigh, and shin may be made interchangeable. Mr. Davies' system has been to design parts of steel, then have them duplicated in 17S aluminum alloy. The result is a leg of only four units of other metal—the ball bearings—and weighing only 3½ to 4½ lb., some two pounds lighter than limbs made in the old way. Castings and drop forgings of magnesium alloys are now being experimented with in an effort to decrease the weight still more. The importance of weight reduction may be understood when it is considered that even the ordinary sedentary office worker takes 10,000 to 15,000 steps a day, and a person with an artificial leg is required to take half of them with the weakest portion of his body, lifting the artificial limb each time. An added 2 lb. in the limb means that he exerts about 20,000 lb.—ten tons —of surplus lifting effort each day.

In forming a hairpin-like depression at the back of the knee portion of the upper limb, difficulty was experienced with cracking at the top inside of the U. Since this depression is made to fit a check cord and a small lug is required at the top of the U anyhow, the difficulty was solved simply by welding up the crack and putting on the lug all at the same time.

Ingenuity has been exercised in planning and fabricating the joints. The knee joint, for example, is composed of an axle-bolt, two ball bearings, two straps, and a center lever with a roller at its outside end, as illustrated. It was necessary, to meet design considerations, that the inner diameter of the ball race be held to ½ in. The side straps and the center lever had been put on previously with set-screws, which did not hold sufficiently, or with

through pins, which weakened the axle too greatly. Since an alloy axle was desired, it was finally designed with three hexagonal sections machined on it, one directly under the head for one side strap, one at the center for the lever, and one at the far end for the other strap. It was necessary that the axle be fed through from one side, so the center hexagon and the end hexagon were made with their width across corners equal to the axle diameter. The center roller lever arm splits and is clamped over the hex; the strap at the far end may be slipped on before the capping screw is placed. This insures that straps and center arm work rigidly together. In use, a strap passes from the wearer's waist belt down the back of the leg, over the roller, and up the front to the belt. Thus when he lifts his waist or shoulder to take a step in the normal way, the front strap is tightened, the roller at the end of the lever exerts a pull on the axle, this pull is transmitted to the side straps, and the leg swings forward naturally. Rubber bumpers in the heel, instep and toe provide an ankle action somewhat similar. As a matter of fact, these actions work so naturally that it is impossible to tell that the limb is artificial unless its action is observed very closely. Many limb wearers do not even exhibit a limp. The ball bearings, incidentally, are "permanently lubricated" by being packed in grease and a retaining gasket later placed on each side to hold the grease in. The foot bearings are actually hermetically sealed. The foot itself is partly made of metal, and can even be produced with five toes if desired.

All these innovations and applications of sound metal-fabricating principles have resulted in a stronger, lighter limb, manufactured in something like one-fiftieth of the former time, and with one man for each twenty-five formerly required. This one may be unskilled, while the former twenty-five all had to be trained mechanics. The fit is much better, the cost is cut 50 per cent, and all parts are interchangeable. Further, a limb can be made so perfect a match that its wearer can appear in knickers or short skirts and low shoes without the slightest fear of detection. Some wearers have grown so skilled in handling these limbs that they can run, play games, or work like anyone else. In fact, thirteen of Dr. Davies' fifteen employees are limb wearers, including two of the four girls working in the office. In addition to their appreciation of the point of view of the artificial limb-wearer, they also serve as living examples of what can be done to overcome a handicap once considered a permanent disability.

Long and Short Addendum Gears—*Discussion*

FRANCIS W. SHAW
Gear Consultant, Heywood, England

This article (*AM*—Vol. 74, page 764) reminded the writer of his own experience in the same direction. Nearly 30 years ago, when the writer was new at the game of gear "faking," any attempt to depart from standards was deemed a mistake. In aiming to get better approximations to theoretical geometrical progression in the speeds and feeds of machine tools, I conceived the idea of cutting different numbers of teeth on gear blanks than their diameters called for. Sometimes too, where a pinion had a hole so large as to leave too little material between the hole and the roots of the teeth, the pinion would be enlarged and the gear correspondingly reduced. Generally, however, the pitch was altered, more or less teeth fitting the center distance than there would have been with unmodified gears.

Now, usually, there is more to be said in favor of increasing the diameter of a pinion and correspondingly decreasing the gear diameter than against, the result being to strengthen the pinion teeth. A correct cutter, sunk to the standard depth in both gear and pinion, will leave the teeth the correct thickness for engagement without backlash.

The trouble arrives when, for manufacturing reasons, it is desired to give the tooth thickness, for then either the man who gives the dimensions will put them as for standard gears or find himself faced with complicated and tedious calculations. So tedious and time-occupying, indeed, are these formulas, that the general practice is to be excused—that is, generating a modified pair carefully, and by taking several light test finishing cuts until they mesh correctly at the proper center distance, utilizing these gears to ascertain the tooth dimensions.

The writer has heard it often expressed that since both gears have been generated by the same or similar cutters they cannot fail to engage perfectly at the new center distance entailed by the diameter modification of only one gear. This is a mistaken impression as a little consideration will disclose.

Consider, first, the effect of generating an over- or under-sized blank with a rack-form cutter. The rack by nature has an invariable pitch. It will, therefore, generate in relation to a circle on the gear being cut at which the pitch corresponds to its own pitch. In an over-sized gear, that circle is nearer the roots than in a standard gear; in an under-sized gear it is nearer the crests. A little study will show that the effect of generating either above or below the nominal pitch circle is to thin the teeth at the nominal pitch circle. Consequently, backlash will exist in gears cut the standard depth with accurate cutters.

With gears generated by the pinion-shaped cutter system, the trouble is even more pronounced, for not only are we concerned with the non-coincidence of the gear's nominal and actual pitch circles, but with the non-coincidence of the cutter's nominal generating and actual generating circles.

The writer of the comment, with which this contribution deals, evidently realizes that in gears in which one member only of a pair is modified, the backlash is greater than in standard gears, but is of the opinion that it is not much larger. I have actually seen a number of pairs of gears cut on gear shapers, all with the same 4-pitch 14½-deg. cutter, small gears meshing with large gears, small with small, standard with modified, indeed, every possible combination. For those in which one blank had been reduced and the other correspondingly enlarged, the meshing was perfect; in some of the others, it was far in excess of what could ordinarily be allowed to pass.

In my more recent practice, I have arranged to increase the root diameter of one gear of a pair and decrease the crest diameter of the other so as to avoid bottoming.

For internal gears, it is preferable, I think, to increase the diameter of both gears equally, the internal diameter of the internal gear to the interference circle, and so avoid that trochoidal interference between the points of the pinion's teeth with the points of the gear's teeth.

EXECUTIVE

Itemized Pricing

Some purchasers of machinery demand a lot more for their money than others. By the time a manufacturer has their equipment set up, tooled up, the operators instructed in its use, and has filled their other service requirements, there is little profit left. Of course, these services are not free. Each machine sold must bear part of their cost, if the manufacturer is to stay in business. Would it be more equitable to separate these extra charges from a price based only on manufacturing and selling? Or would such a policy create more difficulties than it cured? What do you think about this executive problem?

EXECUTIVE salesmindedness varies inversely with business activity. Men who have grown up in the engineering and production sides of business find themselves taking an increased interest in the mechanics of obtaining orders. Such was the position of Donald M. Graham, President of the Viking Tool Works. Formerly, he was content to leave control of the company's selling policies in the capable hands of Frank Wallace, his Sales Manager. But now, he made it a point to discuss details of sales technique at least once a week.

"Congratulations on the increase in orders last month," said Graham. "It's gratifying to know we're on the right track. Is there any way the plant can cooperate still further in your selling program?"

"I've had in mind for some time a plan that would revise our methods of pricing," said Wallace. "I think it would create a better understanding between ourselves and our customers."

Graham seemed interested but with a doubt in his mind. "You realize, of course, that our prices are now as low as is consistent with sound business."

"Yes," said Wallace. "I didn't mean a price reduction but rather a more equitable means of determining price. Under our present set-up, all charges for engineering, demonstrating and servicing are grouped together with the manufacturing cost in the selling price. This policy worked satisfactorilly when our machines were simpler in design. But now, the incidental services have increased and form a sizable percentage of our total costs. Why shouldn't we segregate them? Show in our quotations just what we ask for the machine itself and the additional charges for development, tooling, and other services."

"But what's the advantage? asked Graham.

"Many of our customers make standard lines of machinery," said Wallace. "When compared to theirs, our prices may seem high because these firms forget that we are going to a lot of extra expense to fill their needs. Quoting separately on the additional items would readily show just how the price was made up. Instead of giving away so-called free service, we'd make a definite charge for it and relieve the machine proper from that much cost."

"Development, demonstration, and other forms of service would still be needed," said Graham. "The customer would have to pay for them in any case. I don't see that he'd feel any happier because of a breakdown on the price."

"But all customers wouldn't pay in the same degree," said Wallace. "Some of them have skilled mechanics, who can set up the machines, and experienced operators, who can run them without being shown how. Their men take good care of the equipment, and we have no need to give it additional attention. Other concerns have to be shown how to do everything, or we have to do it for them. They abuse the machines, and our service department is kept busy sending men to their plants. Careful users should not be penalized for the careless ones as they are when each machine bears equally the cost of these extras."

"On the face of it, your contention sounds fair," said Graham. "But I'm afraid you'd find it more of a hindrance than a help in selling. The more detailed your price breakdown, the more your prospect will try to pick flaws in it. My advice is to leave well enough alone."

"That may not always be possible," said Wallace. "Customers are growing less inclined to accept an all-inclusive price. It might be a smart move to anticipate demands for more specific information."

FORUM

Discussions Of Former Subjects

A Dollar Down

Installment selling of anything is economically sound, provided the credit risks are rated on the proper basis. Thus a much wider use and distribution are given to the product. Remunerative work is supplied to the workmen, a profit is earned for the company, and others are enabled to buy the things as they are needed and not compelled to wait until able to pay cash. These considerations apply to the sales of machinery as well as to smaller articles sold at retail. So extension of installment methods is desirable.

There are three fundamental reasons for the purchase of new machinery and equipment: to improve quality, to increase capacity, and to reduce costs. The last is the most important reason, as anything which will reduce the cost also tends to improve the quality and to increase the capacity. Cost reduction implies increased profits, thus providing a margin to meet installment payments. Nothing can be sold for cash to a company having little or no money reserve, but if it has a good credit rating many things are possible. Cash purchases of machinery greatly increase the capital outlay of the company. Under the installment plan, the same equipment can be obtained at a much smaller initial addition to the capital account and the remainder paid off from the savings made possible by its use. As a general thing, the down payment is so much smaller than the cash price that sales resistance is broken more easily. The big thing is that both buyer and seller profit from such a deal. —L. O. Brown.

Free Advice

In a large company, it would be an additional burden on the senior executives if they were expected to act the parts of family lawyers. To many men, the feeling that the executives would be willing to give their judgment of the best way to overcome some personal trouble is a great factor in stopping worry. It is essential that it be made clear that the advice given is purely as one man to another and that the company is not concerned in any way with the matter under consideration, except the loss of time spent in consultation. I sought and obtained advice from a senior company official on one occasion in which it was essential that my advisor in the first instance should be a man of affairs and familiar with the engineering profession. A lawyer could have advised me of the legal aspect but not of the professional viewpoint.

—S. A. Knight,
Manchester, England.

Buy Design?

Detail prints are private property in the automotive field. Suppliers will seldom send anything but outline drawings until an order is secured, and it takes a healthy order to get full details. Detail or even sectional drawings of successful units are very convenient to have when designing new units. It is not the purpose to copy these units exactly but only to see the proportions of a successful design. It is common practice in the automotive field to buy a motor car or truck and dismember it, making notes of all parts and analyses of many parts to see of what they are made. If such a practice is profitable, then it certainly would be advantageous to have full detail drawings. Prints sent in by suppliers should be considered confidential and not shown to outsiders, but free use may be made of prints in designing similar parts. —Harry I. Hazzard,
International Harvester Company.

Cash or Check?

Because a man lacks faith in banks or confidence in his local merchant is a very poor excuse for wanting his employer to pay in cash. Paying employees in cash was very good some years ago when a large portion of the working class were foreigners, many of whom were unable to read or write their own name in English, but who could always count money.

Paying by check is an advantage to the employer and is a more efficient way of handling the payroll. Were it not for improved methods, the working man would not have the luxury he is now enjoying.

—W. F. Oberst,
Assistant Superintendent,
Grinnell Washing Machine Corp.

Sales By Contest

In an annual competition conducted by some 40 chapters of a national organization of which I am a member, a certain credit is set up, for the accomplishment of several activities. These points are awarded the chapters when the goal is reached. The points are awarded monthly as the chapter activities occur. The local officers and directors are judged as to their efficiency in chapter management by the total points their chapter has earned. The result has been that there is a keen rivalry among the chapters for a handsome trophy annually awarded for the top position. In addition to the trophy, each chapter is paid a definite amount of maney for each point earned. The plan has been the means of building up an enthusiastic chapter and national membership. A sales contest, based on sound principles and well thought-out plans, would go a long ways toward bringing back that which a number of us seem to have lost—selling enthusiasm and selling consciousness.

—Thomas B. Frank, *Treasurer,*
Cincinnati Planer Company.

Why Conventions?

If a small concern were to join all of the many insurances and beneficial organizations that are seeking new members, it would raise its selling prices and overhead beyond all reason, and likely send it to the wall. For every worth while benefit, one might receive through a single medium of this character, the absolutely worthless ones would reach to a high figure. Ability to select those associations and insurances which are of greatest value to your business,

and which are actually vital to its welfare, is highly important. We are all prone to be lured by fantastic methods of business-building; methods of which we are totally ignorant, but which are highly colored for our imagination.

It is better to stick close to honest and fair dealings along one's road to success. Nothing brings business faster than giving a value equal to the compensation demanded for it. Far better to spend the money in legitimate advertising.

—RAYMOND DAUTERICH,
Crescent Engineering Company.

Does Frankness Pay?

For a man to disclose to his employer his intention to seek a fresh post is simply to invite his employer to relieve him immediately of the post he actually holds. The bargain of service between employer and employee is simple from a material point of view. As long as the worker remains a source of profit, his services will be retained. If and when he ceases to be a source of profit, his services will be dispensed with. The employee on his part engages himself because he considers the position to be to his advantage. If another more profitable post presents itself, he would do his best to obtain it.

The question of frankness, apart from the question of paying, is a question of ethics. If the employer decided to replace the employee, he would complete his plans and engage the new man, before he gave the old one any intimation of the impending change. So it seems fair and reasonable that the employee should perfect his plans before advising his employer. Having completed his plans, he will give his employer notice as soon as possible. —JOHN ATHERTON,
Heywood, England.

Friendliness or Aloofness?

As I go back over my manufacturing experiences and recall the several different superintendents, one stands out head and shoulders above all others. As I try to analyze the reasons for placing him in this position, this one thought is not to be forgotten. He was the only superintendent who spoke to me on the first day I began work at any factory, and the only one who ever showed more than a passing personal interest in his employees. Old employees received his first thought and consideration; he attended every employee's funeral or sent flowers. He was always present when one needed a friend.

A man of this calibre does not stay long in one position, but advances steadily. He is now president of the company, and because of his present position, cannot maintain the personal contact with all new and old employees. He has, however, instilled into the minds of his subordinates his thoughts in this respect, and they in turn pass them on to the individual employees. The company, of which he is president, has earned dividends for the stockholders during this depression, and I doubt if he has had the worries most presidents have had recently. Last but not least, he has had a low labor turnover, which means a satisfied personnel.

—O. M. DUNTON,
Superintendent of Inspection, American Seating Company.

Marking Time

How is it going to help business recovery to place on the market a new hammer which will do just as good work as the old at a price 20 per cent less? That is not enough reduction to stimulate trade. It gives an advantage to the manufacturer who introduces it, but the advantage is at the expense of others. It is far better for all concerned to wait till there is business enough for all. There is more profit made by introducing it then and less loss to the others.

There are two kinds of design that should be pushed now. One is the product that can only be introduced slowly. In the machine tool line, it takes years for the users to become convinced that a new machine is an improvement. So waiting till the market is good may mean delaying sales till the next depression arrives. We hope that by introducing our new welded construction of tool grinding stand now our customers will be ready to buy them next year.

The other kind of new design that should be introduced now is the kind that people are waiting for. We have one proposition from a customer who wants to replace old equipment with new improved designs. But our designs are not ready, and no one else has satisfied him. He is not the only one with money to spend who is waiting for the manufacturer to produce what he wants. It would be folly to hold up that kind of design till business improves. By that time, others might get ahead. If a new design is wanted now, it should be pushed now and not held up. There can be no advantage in waiting.

—A. W. FORBES,
Forbes & Myers.

Shirt Sleeves or White Collars?

Every manufacturing plant has its design, research, planning, and cost departments. Although on paper, these departments are classed as overhead, factory managers know that they produce just as much as any of the machine departments. Without intelligent machine hands, production costs rise. Without intelligent design and research, production costs rise. Without intelligent planning departments, production costs soar. And without intelligent cost departments to record the facts, the management does not know where it stands. The man in the shirt sleeves should not look on the white collar toiler as a burden. He is far from such. If the man at the machine is putting all he has into his job, he cannot be designing or planning or considering costs. This is a day of specialization. The man at the machine is a specialist; so is the white collar man in the design and research, the planning, and the cost departments. One cannot get along without the other.

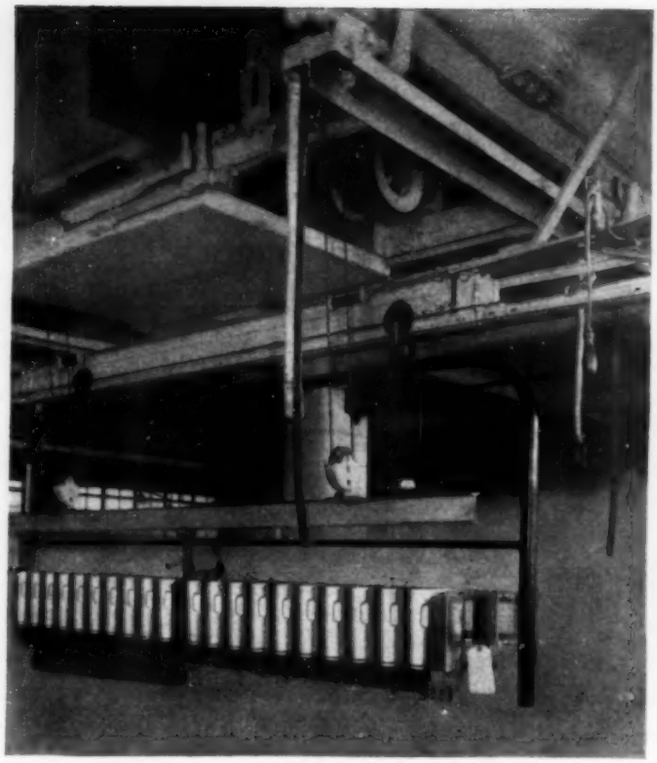
—FRANK BROWETT,
Triangle Tool and Die Company.

Shifting the Burden

When we hear of a plant running two or three shifts, we are envious, as we know this reduces the overhead. In good times, when we would like to run more than one shift, we cannot get capable men, and in poor times, we cannot get enough work to keep one shift busy.

On work running into quantity, such as automobile manufacturing, we believe it would be economical to plan for the use of multiple shifts. In the smaller shops and the machine tool industry, as there is a shortage of men, we do not think it would be possible to run more than one shift.

—U. SETH EBERHARDT,
Works Manager, Newark Gear Cutting Machine Company



A recently installed conveyor system facilitates the manufacture of step-by-step central office automatic telephone equipment

Fig. 1—Selector, connector, and line-finder shelves are handled in steel tube carriages which may be replaced at slight cost if design changes are made in the product

Monorail for Progressive Assembly

W. H. PAGENKOPF
Hawthorne Works, Western Electric Company

THE monorail conveyor system handles switch units in groups known as shelves. Such a shelf shown in Fig 1, consists of a number of switch units, all of one type, and their associated multiple banks, mounted on a unit frame suitable for shipping and capable of being readily mounted one above the other on permanent frameworks in telephone central offices.

Unlike most monorail conveyor systems, where an economical method of transferring material from one place to another is the major consideration, the installations described serve primarily as a means of conveying shelves on specially designed carriages along a progressive assembly and testing line. It is necessary to hold the carriages rigid during the frame assembly, wiring, and soldering operatings, and for this reason, pedestals are located under some of the monorails to which carriages can be anchored. Pedestals are not provided along the line-finder assembly line because the carriage extends to the floor and has special holders that can be locked against the floor to hold it rigid.

A typical plant layout of the benches and monorail equipment is shown in Fig. 2. Shelf assembly is started at point *A* where the shelf framework is removed from the storage space and mounted on a carriage or conveyor. The framework assembly is completed at point *B* and given a thorough inspection before it is moved to point *C* to receive the switch units which previously have been asembled, adjusted, and inspected by a separate progressive system. The monorail turntable is next in line and it serves to reverse the carriage before it is sent to the testing area. The turntable is provided for two reasons. First, it reverses the position of the carriage so that it always goes around the monorail circuit facing in the same direction with respect to the rail; second, it reverses the shelf at a point in the line where the operators have completed all of the work on the rear side of the shelf and are ready to work on the front side. This is desirable because it allows all of the operators to face in the same direction with respect to illumination. Minor assembly and adjusting operations, including the mounting of bank equipment, are completed at point *D*, and from point *D* to point *E* final testing and inspection operations are completed. Testing routine directs the operation of the switches and relays so they perform all of the functions that the equipment is called upon to perform in the telephone exchange. This gives the shelf a final check for correct adjustment and short circuited, reversed, or broken wires. Final inspection covers the items that cannot be detected by the test sets and that must be checked visually. Apparatus covers and preliminary packing details are placed on the switch units at point *F*, and finally, the shelf is unloaded with a one-ton electric hoist and prepared for shipment. The unloading operation completes the cycle, and the carriage is ready to be loaded with another frame. The cycle for each carriage is completed every twenty-two hours with an average output of two shelves per hour. A total of fifty carriages is used on the monorail system shown by the diagram.

Referring again to Fig. 2, it will be noted that there are seven rails, two of which terminate near the points where the rails converge into a single rail. These two rails are not used as assembly lines, but serve as a storage space for empty carriages or a place where shelves that do not pass inspection can be side-tracked until difficulties are corrected. Under normal operating conditions these rails are empty. When minor defects are found

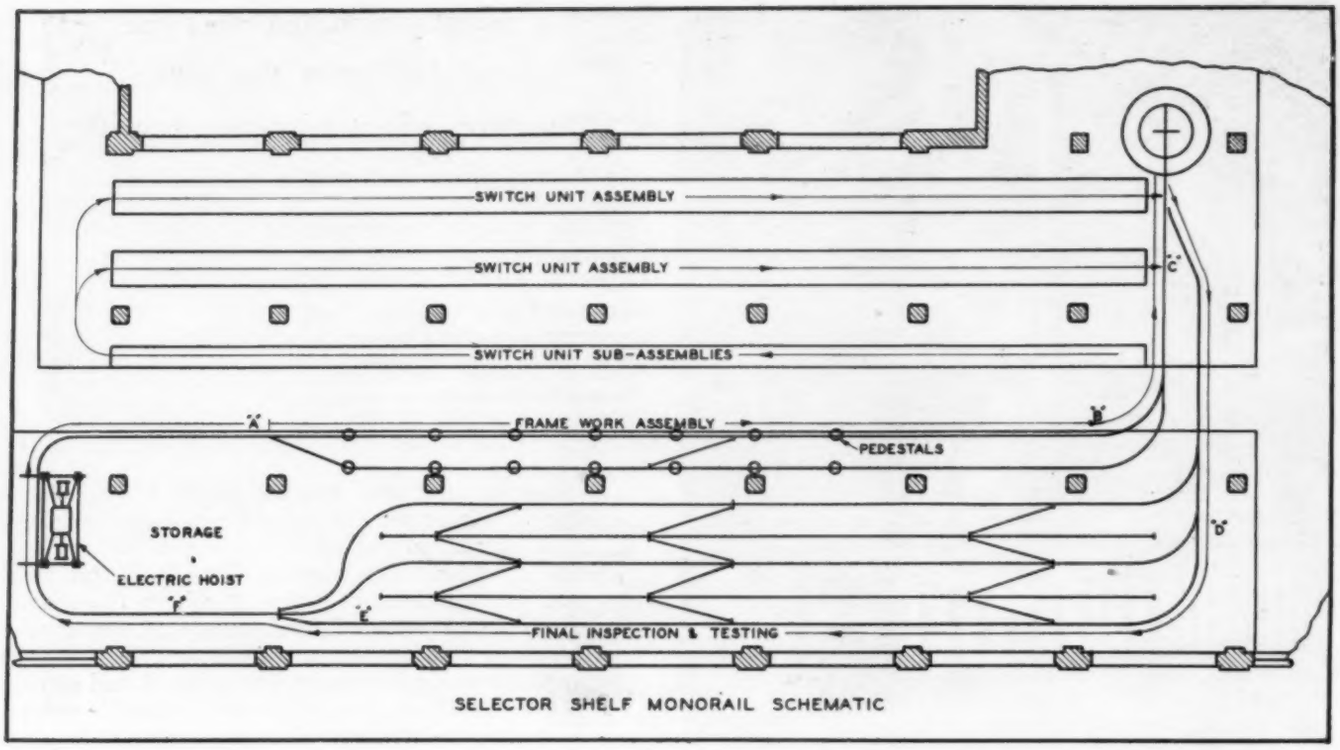


Fig. 2—The conveyor layout provides continuous progression of parts and two storage racks for those units requiring special inspection or adjustment

on a shelf, a red flag is placed on top of the carriage to notify the repair operator that a defect is to be corrected. When the defect has been corrected, the flag is reversed to indicate to the inspector that the shelf is ready for further operations.

Three monorail conveyors of this type have been installed in the assembly departments. The installations are alike except for the type of switches they handle. Figs. 1 and 3 are photographs of the selector and line-finder shelves respectively together with the associated monorail carriages. Fig. 4 shows the selector monorail system.

The carriages are built from steel tubing and have a baked black enamel finish. Steel tubing was used because of its strength and appearance. All castings, braces, and trolley couplings are welded to the frame for rigidity and safety. The lugs, on which a shelf framework is mounted, are hardened steel pins mounted in steel castings with phenol fibre bushings so the shelf frame is insulated from the monorail conveyor to withstand a 500 volt alternating current, insulation breakdown test.

Because of the ease with which carriages can be moved about, one operator can easily move a line of ten loaded monorail carriages. This avoids the temptation that the operators once had of moving their set to the work in preference to moving the work to the test set.

The necessity of keeping dust to a minimum is apparent when it is considered that small dust particles lodged on relay springs are sufficient cause for the faulty operation of the relay. This demands good housekeeping, which is greatly facilitated by supporting the monorail from overhead, leaving the floor clear from obstructions and easy to keep clean.

The adaptability of the monorail equipment to changes in switch and shelf design and increased production

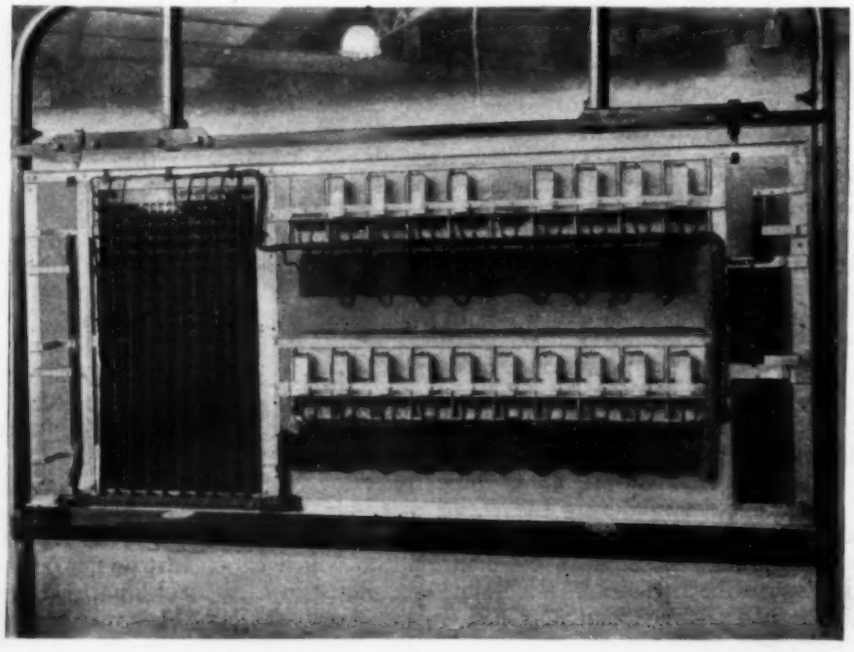


Fig. 3—The line-finder shelves use larger carriages with special holders that may be locked to the floor to hold them rigid

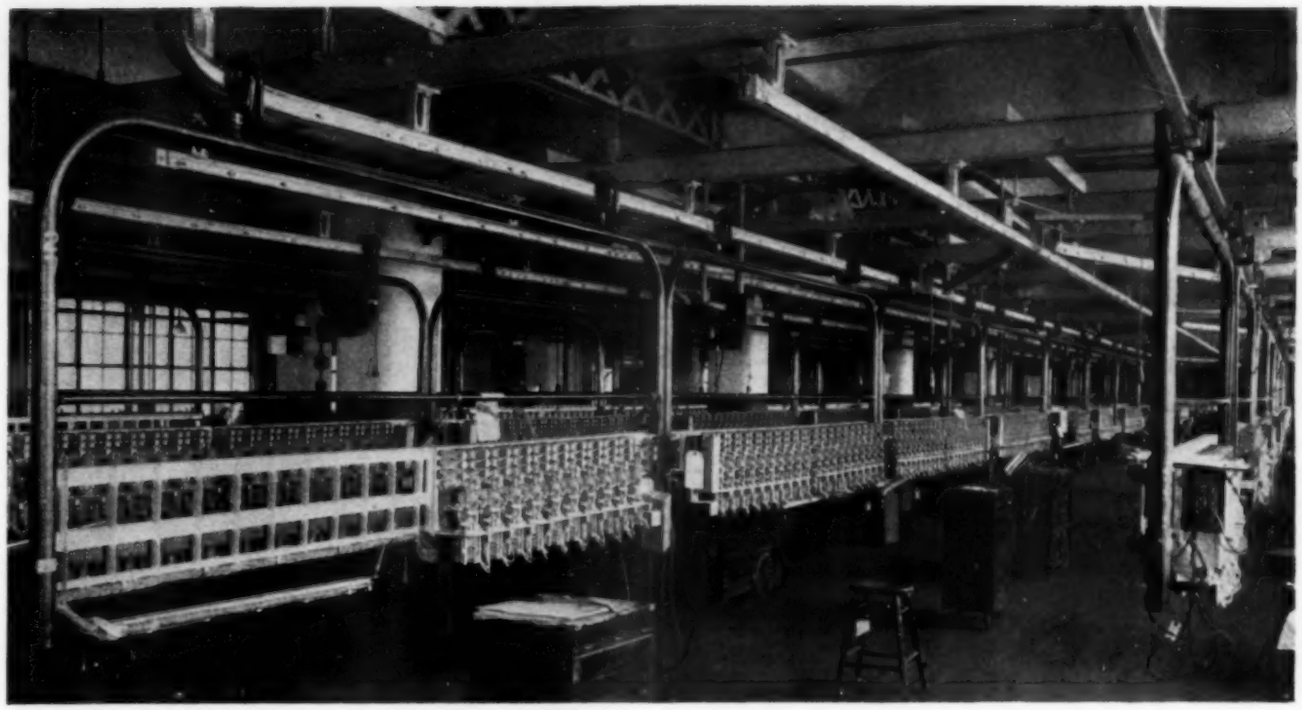


Fig. 4—The monorail system affords convenience to the operator and keeps the work free from dust, highly important for automatic telephone equipment

schedules was considered an important factor. Changes in switch and shelf design will not retire the equipment through obsolescence. The carriage frame may become obsolete, but this is not a costly item. The more costly items such as trolleys, couplings, and the monorail structure can be used regardless of changes in switch-shelf design. When it becomes necessary to manufacture boards on an emergency basis, monorail carriage frames can be easily and quickly built. Additions to the present installations will not be difficult, because the equipment is easily extended and adaptable to adjoining buildings.

The appearance and neat arrangement of the equipment is a great asset to the supervisor in charge of operations. Wide aisles are always open, and shelves are easily located. When the output supervisor starts a shelf assembly off on the conveyor, he can be reasonably sure that the shelf will be completed in time to meet the scheduled shipping date.

Trends in Locomotive Lubrication

LUBRICATION of motive power is receiving careful attention by large railroads, as well with the idea of saving a little oil or grease as of securing more consistent lubrication of moving parts and reducing the cost of maintenance. Constant force feed is being used on crosshead guides and on some other bearings, the oil being pumped direct to the bearings from a central mechanism as in automobile practice. Grease lubrication, in which the Alemite system plays an important part, is a decided change for the better since the days of the plain grease cup that adorned crossheads, side rods and other parts.

Inquiries to a number of the leading railroads elicited considerable detailed information such as:

R.R. 1—"We are now applying Alemite fittings to practically all the moving parts of the locomotive as well as to spring and brake gear."

R.R. 2—"The Alemite system has been adopted for crankpins of all locomotives in heavy, fast, passenger service. It has reduced hot crankpins and resulted in slower wear on pins and bushings. This is because grease is forced between the bearing surfaces before the locomotive starts and also because the grease is kept cleaner by being in the gun."

R.R. 3—"We have equipped practically all the rods on our heavy power with Alemite. We also find that the floating type of hub liner between engine truck wheels and trailer truck wheels and box has helped reduce wear."

R.R. 4—"We use a floating bushing on driving boxes, trailer and engine truck, and inside grease lubrication of crankpins. The ends of crankpins have a 1-in. hole drilled to the depth of the bearing surfaces with ¼-in. radial holes to the bearings."

R.R. 5—"We are now Alemiting valve gears, driving box shoes and wedges, trailer truck and engine truck hubs, bell bearings, crosshead and guides, front end of main rod and the driving brake fulcrum bearings."

Floating bushings seem to be increasing in favor, being drilled radially for lubricant regardless of the method of applying it. Valve gear bearings are fitted to take the grease gun and so insure new, clean lubricant being introduced between the bearing surfaces. Interest is also being shown in constant-feed lubrication, as previously mentioned, and it seems likely that this type of lubrication will increase with the newer locomotives and the longer runs that are the order of the day.

New Tool Stands for Old

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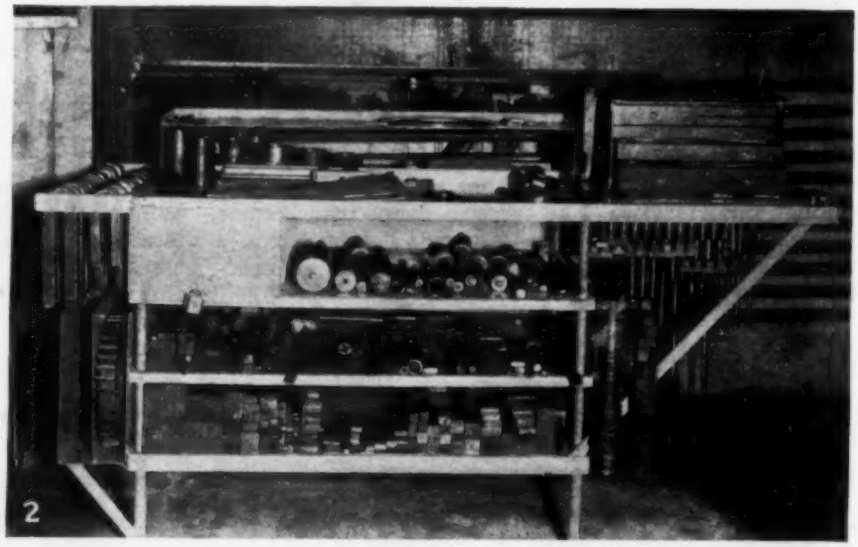
C. J. FREUND
Apprentice Supervisor,
Falk Corporation

These three examples of tool stand modernization suggest dull-times activity for other shops

1



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DEVELOPMENTS in machine tools require the up-to-date shop to consider new equipment constantly. Rarely, on the other hand, is a great deal of attention paid to modernization of other items of shop equipment. The three old tool stands pictured here were of the usual type—no better, and no worse than those to be found in the average jobbing shop more than ten years old. They were unsightly, disorderly, time-wasting—gathering places for dirt and rubbish, hard to clean and hard to clean around, with shelves and compartments difficult to reach, in which tools were piled without respect for order or regard for the possibility of damage.

But at the suggestion of Works Manager Harold S. Falk, machine shop foremen of the Falk Corporation began joint development of new stands. The "after" pictures show three examples of the results, all developed from simple two-deck tables. Each is designed and planned for the particular machine it serves, size and construction being adjusted to the requirements. Pipe forms the columns, to which the steel plates and shapes of the top are welded. Finish is gray paint to match the shop interior.

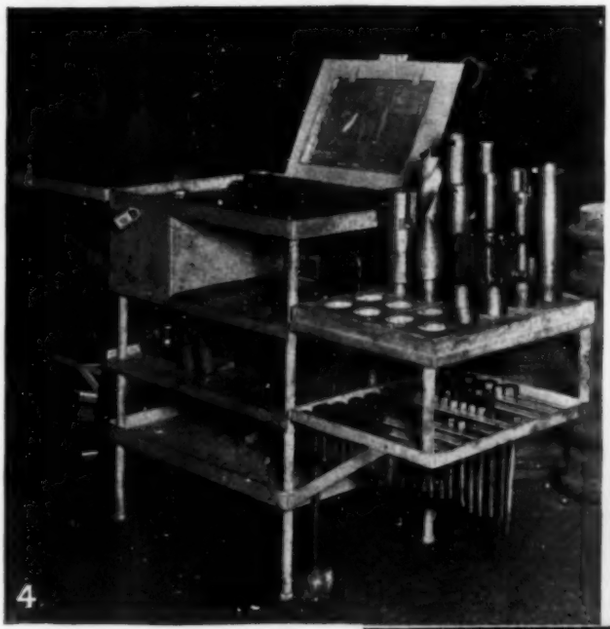
These stands are neat and clean, save wear and tear on tools and equipment, and lessen time waste by providing a place for everything. Tools and instruments not in use do not accumulate about machines. The floor about them can be cleaned easily, valuable space is saved, and best of all, building of the stands provided work for men who otherwise had none.

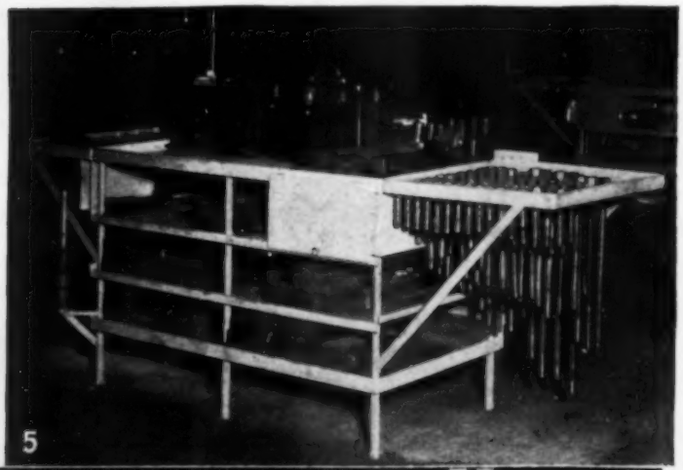
Fig. 1 shows the old tool stand for a boring bar. In Fig. 2 is shown the new stand with cutting tools racked at the top, U-clamps assorted for size at the left, tool boxes for day and night men at the right, and bolts, rough washers, and collars assorted for length on fingers below. A lock compartment provides space for special

tools; drills, drill sleeves and boring bars go beside it; and the shelf below provides space for hand tools. Cutters are racked at the left, distance blocks on the bottom shelf, and job cards are filed in a small box at the left of the toolboxes. A place is thus provided for everything, while the upper surface of the stand itself is left clear for the blue prints of the job, special tools, and accessories in immediate use. The workman is naturally encouraged to maintain this neatness of arrangement, and the ultimate result is much improved shop appearance and effectiveness.

Similar basic design is used for the boring mill tool stand, Fig. 4, except that blueprints are clipped at back, job cards filed in a pocket behind, and the toolboxes placed at the opposite side to provide room for a boring bar rack. The old stand is shown in Fig. 3.

Another variation, designed especially for the planer, with toolboxes in the middle, a job card box next to the U-clamps, and four long troughs for long tools, bars, etc., at the back, is shown in Fig. 5. Only the end of the upper trough shows. For contrast with this convenient, efficient stand, the old stand which was replaced is shown in Fig. 6. As well as saving space and improving appearance, the new stand offers greater protection to tools and is far safer for workmen to use. There are no sliding drawers to jam or break and a more orderly arrangement of tools; thus the danger of injury to fingers or hands is avoided.





From Mining Machinery to Ordnance Gun Mounts

CAPTAIN WALTER SODERHOLM
Ordnance Department, U. S. Army

In his two preceding articles Captain Soderholm has shown how ordnance practice follows modern manufacturing methods, how almost any decently equipped metal-working plant can handle ordnance material. In this final article he shows how a certain mining machinery builder could handle anti-aircraft gun mounts. Equipment and personnel are immediately available, but it should be clear that only "educational orders" will provide the essential experience and training.

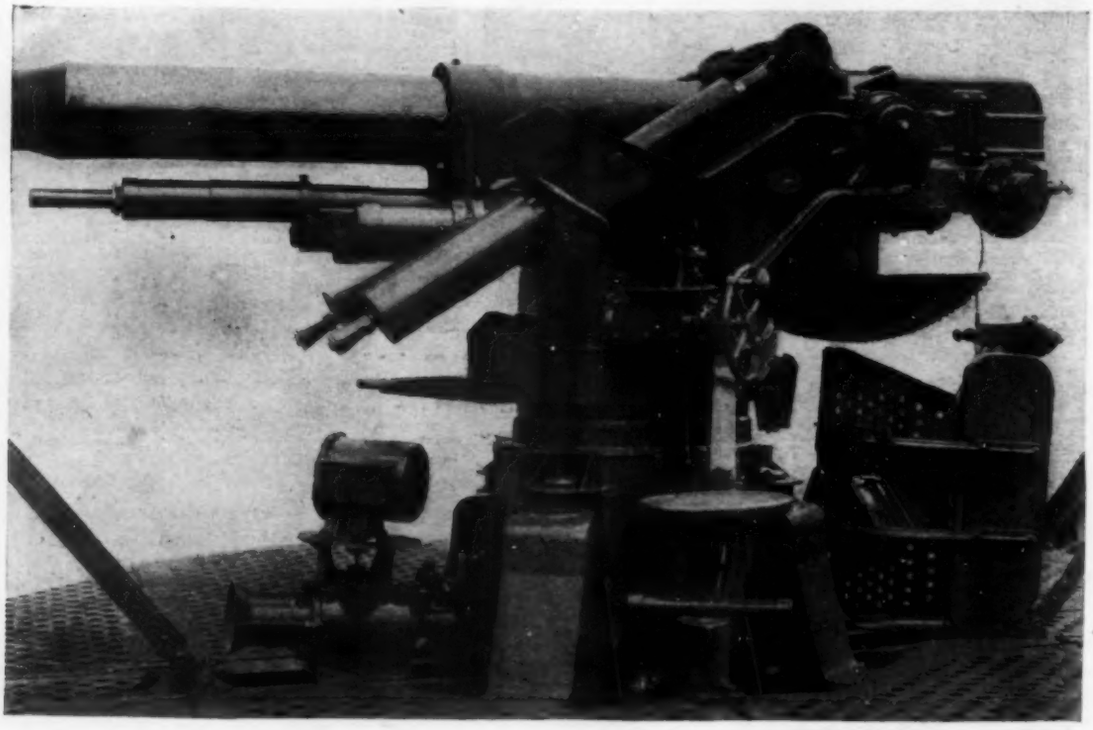
"PEACE-TIME planning for the prompt and orderly war-time production of munitions?' Fine! But tell us—can we turn out ordnance in our shops? What could we make? We have never made any and have no idea what sort of a job would fit our machinery and manufacturing skill."

These comments were made by a manufacturer of coal-mining machinery, employing, normally, about 800 men. But with interest in industrial preparedness increasing, there are scores of metal-working shops throughout the country who also ask, "What part are we best prepared to take in our defense program?"

A brief study of the results of a survey of this mining machinery factory is interesting. Bear in mind that ordnance munitions are largely non-commercial. The pages of the *American Machinist* have already carried a brief description of the method of survey used, in cooperation with a factory's production personnel, to determine the ordnance article which a factory is adapted to product and to estimate its capacity. This study is based on the actual findings of such a survey.

This plant's product incorporates a wide variety of materials designed to withstand medium to high stresses. The degree of workmanship and finish required varies from "as cast" or "as forged" to the finest; tolerances of ten-thousandths of an inch are attained where necessary, while those to the thousandth are commonplace. Components vary in size from small parts to those that require crane service for chucking and set-up. Modern welding equipment and practice are evident. Finished product is often heavy and large; assembling and shipping facilities are appropriate. Machine tools are of a wide variety of types and sizes, the equipment being general in purpose rather than special.

Now then, what ordnance article can be made in a shop with these general characteristics? Looking at the



Close-up of 3-in. anti-aircraft gun mount, indicating welded construction

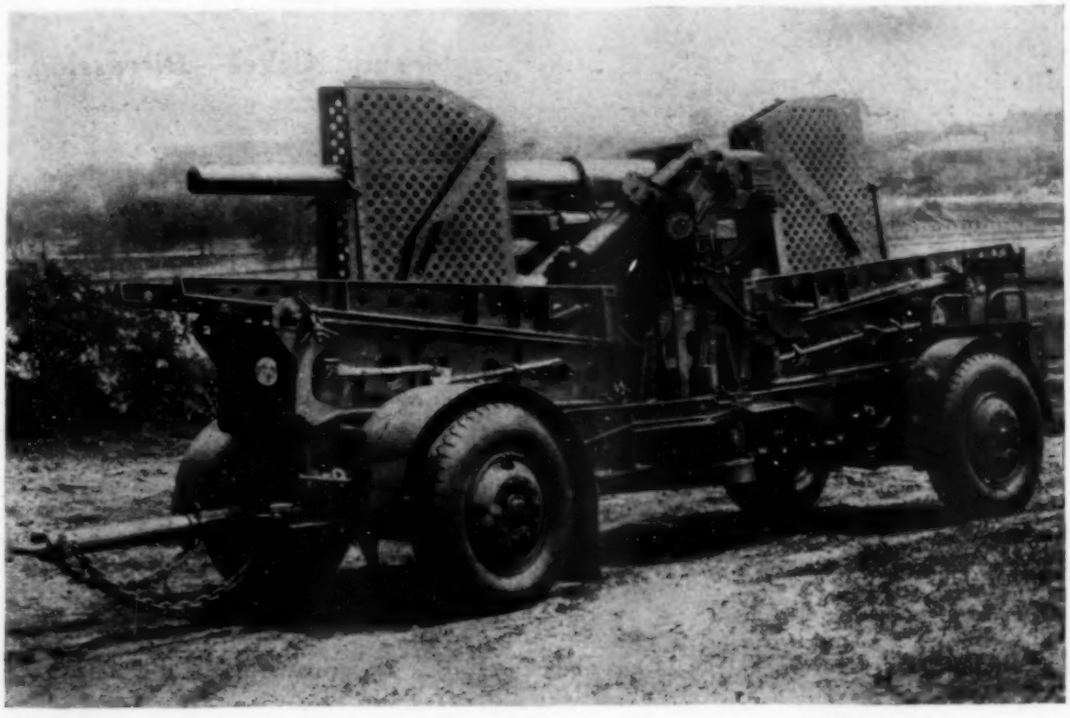
survey data giving the machine tool requirements for items like fuzes or artillery shells, it is evident that their manufacture here would make no use of the majority of the installed machine tools. Cartridge cases, press jobs primarily, certainly do not belong. But mobile artillery carriages—the infantry mortar, the pack-howitzer, the 75-mm. field gun, or the anti-aircraft gun mount—seem to fit in fairly well. Because of the importance of the 3-in. anti-aircraft gun mount, the survey was completed for it. Incidentally, it is a bigger job by far than the others mentioned and serves admirably to demonstrate that the survey or "measuring stick" yields satisfactory results whether the ordnance article be complex or relatively simple.

The survey data for the 3-in. anti-aircraft mount includes a summarization of the minimum size machine tools and the unit machine-hours required, on the average, for its production (the cannon excluded). There is also a bill of material. Our manufacturer noted from this that nothing but commercially procurable materials were specified and that they were closely similar to those used in his own shops. The drawings showed finishes and tolerances more liberal than expected, the finest being those bearing bores, or journals, to which commercial ball or roller bearings are fitted. Wheels, tires, springs, and similar parts are commercial. The weights and sizes of parts are no greater than those to which the plant is accustomed, hence, such items as crane service, aisle space, assembly space and shipping facilities are, in general appropriate. The use of built-up and welded structures in lieu of castings is a well-developed practice here, hence the welded top carriage, pedestal and other parts of the gun mount should offer no particular problem.

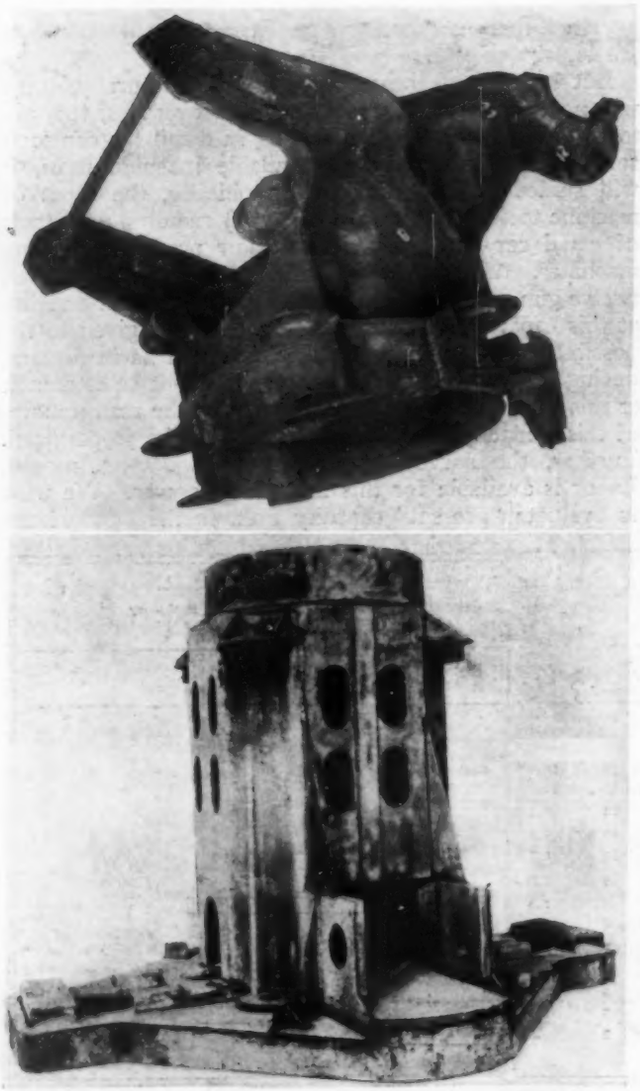
But how about the machine tools? Naturally, these will not balance; some shortages and overages, too, are to be expected. Instead of listing in detail the comparison between required and available machine tools, it will suffice here to compare, graphically, the types of machine tools (all sizes in each type) required with tools of equal capacity available and now producing mining machines. This chart is based on the production of twelve gun mounts per month. Why? Well, in arriving at this capacity estimate, consideration was given to the possibility that coal mining machines will be in demand during a war, although this demand cannot be estimated at this time. A reasonable capacity for the manufacture of this company's regular line should not be jeopardized. Further, the survey was based on a 250-hr. month. Labor is available for this now; so is power. We wish to evaluate "present" capacity first, in the light of the

A Chart Showing the Equipment Adaptability of a Manufacturer of Mining Machinery for the Production of 3" Anti-aircraft Gun Mounts

Machine tools required for production of 12 Gun Mounts per month			Machine tools available, expressed as a percentage of those required
Class (all sizes)	No.	% of Total Mach.Hrs.	100%
Engine lathes, medium	39	22	102%
Horizontal boring machines	30	20.3	16%
Horizontal milling machines	15	10	66%
Turret lathes	12	8.1	141%
Planers	10	6.8	70%
Miscellaneous	10	6.1	280%
Engine lathes, large	9	5.9	44%
Drilling machines	8	5.5	287%
Vertical milling machines	6	3.8	116%
Arc welders	5	3.4	180%
Vertical boring mills	5	3.1	320%
Shape cutting machines	3	2.3	102%
Gear cutters	3	2.1	333%
Grinders	2	.4	200%



New 3-in. anti-aircraft mount in traveling position



Top carriage and pedestal for 3-in. anti-aircraft gun showing welded construction

more serious machine tool shortages, and view as the inherent expansion possibilities of this plant the efforts of a second shift when this labor can be secured and trained. The selected capacity then is very conservative. It is a minimum capacity with the prospects bright for double this production after things are well under way.

The chart brings out the remarkable equipment adaptability of this factory for the production of anti-aircraft mounts. Machine tools available, and "fit," are expressed as a percentage of those required. Note that in ten of the fourteen classes of required machines, there is an availability in excess of 100 per cent, that is, of requirements for the production of twelve gun mounts per month. There are four shortages, the principal one being in the horizontal boring machines on which are performed 20 per cent of the total unit machine hours; and the remaining three represent 10 per cent, 6.8 per cent, and 5.9 per cent of total machine-hours. However, in these groups, 16 per cent, 66 per cent, 70 per cent, and 44 per cent respectively, are now available. These shortages, let is be pointed out, are not offered or are they to be taken in a hard and fast sense. If actual production were initiated it would soon be discovered, no doubt, that substitutions or short cuts would change these values. They are but estimates, but they are based on actual manufacturing data that represent mean or average methods of production. Our manufacturer can at least do as well; he ought to do better. The conclusion then is dependable—here is a manufacturer whose present adaptability for the production of 12 anti-aircraft gun mounts per month is in excess of 75 per cent!

And similarly, hundreds of factories throughout the country will be "measured" and found surprisingly well adapted to initiate the prompt production of some ordnance materiel in the event of war. They must be given their share of the task before new factories are built, for in so far as the widest use of existing facilities can be made, the problems of power, labor, and machine-tool requirements will be minimized. To save time in getting under way, the machine-tool shortage which the survey pointed to could, to a large extent, be made up by purchases of surplus machine tools from neighboring factories or certain work could be "farmed out" until more satisfactory arrangements could be made.

Considering, along with other factors, the time required to tool up for the production, and the tool-maker and machinist hours available for the task, it appears that deliveries ought to begin in about four months.

"Your survey results are entirely satisfactory to me. Of course, I realize that after we get started our results will not be according to the estimate, but we ought to equal that estimate in the early months at least. As for the machine-tool shortage—it points to some that are definite; but we ought to straighten most of them out by the time we are tooled-up."

"But, now that we know what we are best able to do; we would like to make one or two of these gun mounts and *prove it!* That would give the government a set of proven tools, and our engineers and workmen would be fairly well-trained munitions men!"

Last of three articles by Captain Soderholm.

■

Silver Solders and Nickel—*Discussion*

A. EYLES
Foreman, Sheet Metal Working Dept., London, Midland & Scottish Railway Co.

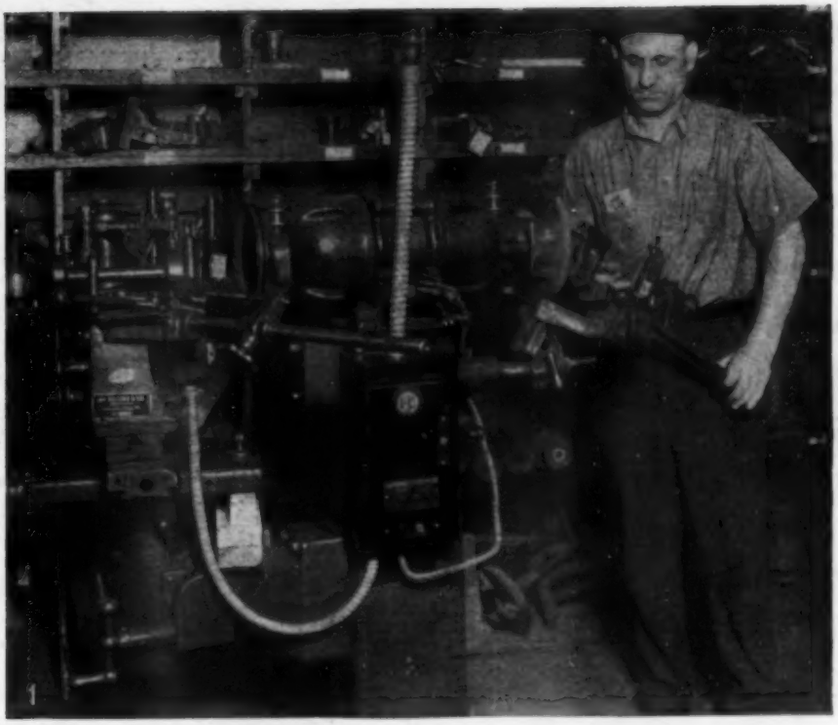
In the fabrication of nickel and Monel metal products and components mentioned under the title above (*AM*—Vol. 74, p. 870), experience proves that excellent brazing is done with silver solders. Many shop managements associate high cost with silver solders; actually, however, because of the sparing way in which they are used, and since joints require little finishing, these solders are very economical to use, in fact, are probably the cheapest jointing materials available for a number of uses.

One thing to remember in silver soldering is to remove the torch flame as soon as the brazed joint is completed, and then immediately to immerse the piece in cold water. By thus doing, the flux is disintegrated—if the brazed joint is allowed to cool slowly the flux usually sets into a hard vitreous film difficult to remove. A little sulphuric acid added to the water used for quenching greatly assists removal of the flux and scale. Joints may be cleaned by filing, grinding or polishing, and then may be burnished if necessary.

Tool Grinding Control

P. E. GARLENT
Master Mechanic,
Timken Detroit Axle Company

One central system supplements the individual tool rooms that serve their respective departments



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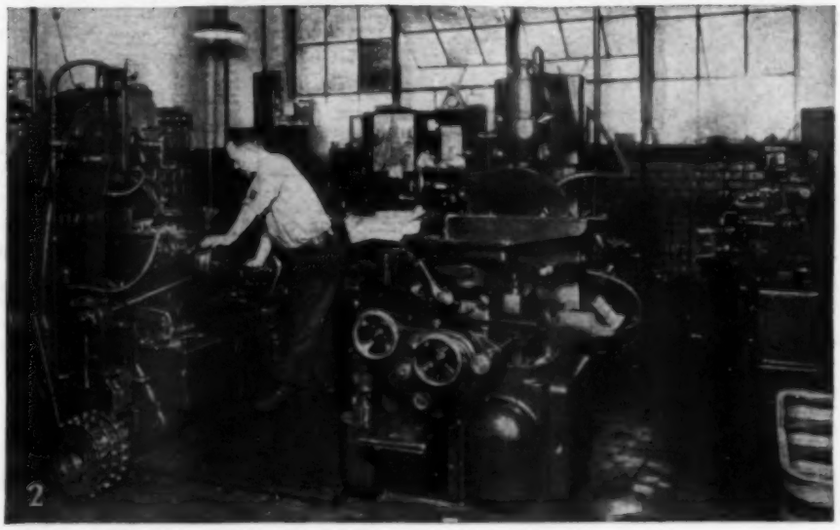


2

UNIFORM tool grinding is essential both to accuracy and economy in manufacture. And uniform grinding can only be secured with proper equipment in the hands of men responsible for results. While some advocate centralizing all tool grinding in one department, we have found it better to have the tool grinding for each department done in the toolcrib of that department. This localizes the work and seems to utilize the services of the tool crib attendant to the best advantage.

We have always had a central system of grinding all the larger universally used tools and tools requiring several successive operations in order to provide the proper cutting edges. This department is centrally located adjacent to the miscellaneous stockroom, and is equipped to take care of such universally used tools as drills, reamers, milling cutters of all descriptions, hobs, hollow mills, chasers, and dies. Fig. 1 shows a corner of this toolcrib.

We also have a grinding department exclusively for straight bevel and spiral bevel gear tools. This department, shown in Fig. 2, is adjacent to the gear cutting department and is controlled by the superintendent of the gear division. It provides us with sharp, correctly ground cutters that are always available for the machines of this department. The head of the department is responsible for the condition of the tools used.

Cutters and hobs for worms and worm wheels are ground in a department given over exclusively to the making and maintenance of this type of tool. It is located near the worm wheel department and is controlled by the superintendent of the worm wheel division. In other words, we hold each division head responsible for his particular class of work. This responsibility includes the maintenance of the tools used and the quality of work secured from these tools.

In addition to the major tool grinding departments already mentioned, we have our departmental toolcrib men who handle certain duties instead of being merely

crib attendants. In some cases they make use of their spare time by keeping records and in other cases by grinding tools as enumerated below, each item showing the work assigned to a different toolcrib.

Sharpen all taps.
Sharpen all drills.
Sharpen all toolbits and make form bits.
Drill out and replace all rawhide-faced hammers.
Cut carbon shanks from high-speed drills to secure a higher price for scrap.
Paint all shop signs.
Keep all departmental records of worn out and broken tools.
Keep records of and order all tool steel and stock castings for tool and machine repair.
Maintain and inspect all gages for one large department of about 400 men.

The method of salvaging the high-speed steel drills is to cut off the carbon shank with a grinding wheel, as in Fig. 3. With the proper wheel this is an effective and economical method. The corner of the gage inspection department in Fig. 4 shows some of the equipment and part of the check board. As will be seen we try to keep our crib attendants busy without interrupting service to the various divisions.

We also provide two pickups a day to every departmental crib, to each tool grinding department and to the toolroom. These pickups gather all tools for grinding and deliver tools that have been ground. The tools are kept in separate departmental boxes or cartons, depending on the type of tool. The tools are also segregated in the grinding departments, which necessitates racks with compartments for each department since every tool leaving the master crib is charged to the expense of the department ordering it. This compels the return of the ground tools to the proper cribs, thereby keeping the various tools separate by departments.

Dynamic Loads on Gear Teeth

An investigation on the loading of gear teeth, instigated by Wilfred Lewis in 1921, has resulted in the recent publication of a final report on the subject by a special A.S.M.E. research committee. Professor Earle Buckingham, of the Massachusetts Institute of Technology, is the author of this report.

This publication includes a summary of fourteen progress reports, the first of which appeared in *American Machinst* on Dec. 13, 1923 (Vol. 59, page 875), describing the apparatus used for the tests. The material covered by Chapter V, "Application of Results" appeared this spring in an article "Spur Gear Teeth—Their Strength and Durability," by Professor Buckingham (*AM*—Vol. 74, page 707).

The report presents a basis for computing gear tooth loads, differing from those in general use and explaining many of the conflicting theories which have been advanced in the past. It sets forth a novel concept as to the effect of speed on tooth loading for various materials. For metallic gears, an increment load is set up, dependent on the pitch line velocity but practically independent of the applied load. This finding is at variance with former methods of computing gear loading, which assured the increment load to be proportioned to the applied load.

The work of the committee comprises a valuable contribution to the engineering world and should put gear tooth design on a more scientific basis.

Change Gears for Gear Cutting

Discussion

JOHN THOMAS

IN commenting on my article (*AM*—Vol. 73, page 894) under the above title, Francis W. Shaw (*AM*—Vol. 74, page 943) wanted to know whether there was any definite plan followed in figuring out the divide gears for cutting the 113-tooth gear. The principle used was described in detail by B. M. Haverstick several years ago in *American Machinist,* although the method of procedure used in this instance was slightly different. For the benefit of those who did not see the description of this method, the details as applied to the present problem will be given.

The problem was to find a 4-gear train which would divide a gear of 113 teeth without the use of a 113-tooth gear. As this is not possible exactly, the plan followed was to find a train which would approximate 113 teeth with a reasonably small error. The solution, as originally worked out, was done in a hurry and no attempt was made to find the nearest possible approximation but merely one which appeared to be "good enough."

The original calculations follow:

Formula for divide gears on machine used

$$= \frac{24}{\text{number of teeth to be cut}}$$

$$\frac{24}{113} = \text{Ratio} = \frac{a \times b}{c \times d} = \frac{\text{Drivens}}{\text{Drivers}}$$

$$\frac{24}{113} = 0.212389380 = \text{Decimal equivalent of ratio.}$$

Ratio 113 : 24 = Ratio 1 : 0.212389380

Ratio table:

1	0.21238938
2	0.42477876
3	0.63716814
4	0.84955752
5	1.0619469
6	1.27433628
7	1.48672566
8	1.69911504
9	1.91150442
10	2.1238938

From the table:

4000	849.55752
2	0.42477876
4002	849.98229876

Taking the decimal 0.982+ as unity, we have the whole number ratio:

$$\frac{850}{4002} = \frac{25 \times 34}{58 \times 69} = \frac{\text{Drivens}}{\text{Drivers}}$$

4002 : 850

The above is all of the work actually required for the solution of this problem with the exception of calculating the error which is omitted since it is not really a part of finding the gear train.

Mr. Shaw also mentioned the time required in the use of some methods for finding gear trains. In recalculating this solution, the actual time required was 14 minutes, including the calculation of error, looking up factors, and everything complete ready for putting gears on machine. Even one not familiar with the method should be able to solve a similar problem in 30 minutes, and the most difficult and stubborn problem should not in any case require as much as an hour. Compare this with the cost and bother of making a new change gear.

The ratio table is made up by successive additions of the decimal equivalent of the original ratio. As this decimal was found with respect to unity, we can set down a new pair of numbers which have the same relation to each other as do the numbers in our original ratio, thus:

(a) 113 : 24, original form of ratio

(b) 1 : 0.21238938, new form with respect to unity

These two terms are of the same value, and as the table is made up entirely of the *b* term, it follows that any pair of proportionate numbers taken from the table must have the same value as the original ratio. This table contains multiples of the original ratio, and an infinite number of forms of the original ratio may be found by moving the decimal point to the right in the right-hand member, adding a corresponding number of ciphers to the left-hand member, and combining terms when thought necessary.

Method of taking members from table:

From the table direct	1 : 0.21238938
Adding one cipher	10 : 2.1238938
Adding three ciphers	1000 : 212.38938

Method of combining terms:

Taken from the table	10 : 2.1238938
and adding	3 : 0.63716814
New term	13 : 2.76106194

The trouble with all of these new forms of the ratio, which we may take from the table or find by combining terms, is that each has a decimal value attached, which we cannot use, since our factors must be all whole numbers.

Take for illustration, the term:

1000 : 212.38938

If we could drop or eliminate the decimal 0.38938, we would have another form of our original ratio in whole numbers.

It might be of interest to note here that we can eliminate the decimal entirely without trouble, but as we could not use the original form of the exact ratio, 113 : 24, we cannot use any other form. Our problem

is to find some ratio differing from the original by the smallest possible quantity.

The elimination of the decimal part of these new terms is one of the purposes of the ratio table and is accomplished in the following manner. Let us select from the table some term, say:

2000 : 424.77876

Inspection indicates that a decimal of 0.221+, when added to our right member, will give a pair of whole numbers with a small remainder. Experience has shown that it is usually difficult to eliminate more than the two first figures of the decimal, and even this is not always possible.

An examination of the table shows that in the first line we have the sequence 0.2123+, which seems to be the nearest to 0.221+ that we can find. Taking this entire term from the table and adding, we have:

2000 : 424.77876
1 : 0.21238938

2001 : 424.99114938

New ratio 2001 : 425 Error = 0.0088+

As no sequence of numbers can be found in the table, which will reduce the remainder, 0.008+, we must conclude that no closer approximation exists. It must be borne in mind, however, that the larger the number in our final ratio the less the final error if our remainder is constant. That is, a ratio having 5000 for a left-hand member will produce an error of one-half that produced by one having 2500 for a left-hand member.

Since this is true, in our search for the ratio having the smallest possible final error, we should start with the highest possible number permitted by the factors at our disposal. It is likely that only one or two "best" ratios exist and to find either of them would require considerable work. If it is not absolutely necessary, we do not look for them, being satisfied with some ratio, not quite so accurate, but which can be more easily found.

As a matter of fact, it would be rather difficult to say just when we had found the best ratio in existence in any specific case. At any rate, the practical errors are so small that the difference between the best and another not quite so good is of really no consequence.

The largest number we can start with is 10000 (100 × 100), but as the numbers likely to contain two factors between 24 and 100 inclusive are rather far apart at this point in the factor table, we will start with a smaller number, say 8500 (we can really start anywhere).

From table	8000 : 1699.11504	
	500 : 106.19469	
From table to reduce decimal	8500 : 1805.30973	
	8 : 1.699115	
	8508 : 1807.008845	
New ratio	8508 : 1807	Error 0.0088+

Since we have a perfect ratio of whole numbers in our original ratio, 113 : 24, we can add or subtract these numbers from any other ratio we have without changing the value and get a whole series of new ratios having different factors (if any). These new numbers must be looked up in factors table to see whether factors exist within our limits, 24 to 100, for both members of our ratio.

As we wish to find the highest number we will subtract and work downward:

8508 : 1807	7491 : 1591
113 : 24	113 : 24
8395 : 1783	7378 : 1567
113 : 24	113 : 24
8282 : 1759	7265 : 1543
113 : 24	113 : 24
8169 : 1735	7152 : 1519
113 : 24	113 : 24
8056 : 1711	7039 : 1495
113 : 24	113 : 24
7943 : 1687	6926 : 1471
113 : 24	113 : 24
7830 : 1663	6813 : 1447
113 : 24	113 : 24
7717 : 1639	6700 : 1423
113 : 24	113 : 24
7604 : 1615	6587 : 1399
113 : 24	113 : 24
7491 : 1591	6475 : 1375 ok.

$$\frac{1375}{6474} = \frac{25 \times 55}{83 \times 78} = 0.21238801 \text{ ratio decimal}$$

Original decimal = 0.21238938

Actual decimal = 0.21238801

As a final check against errors in subtraction and to prove that 6474 : 1375 have the same ratio to each other as 8508 : 1807 we proceed as follows:

From the table:	6000 : 1274.33628
	400 : 84.955752
	70 : 14.8672566
	4 : 0.84955752
	6474 : 1375.00884612

Since the decimal is the same as that with which we started, the ratio must be the same. This problem required eighteen subtractions before we found two members each having factors within our limits. This is probably one of the best possible ratios using a 4-gear train. It would have easily been possible to find a suitable train with half a dozen or less subtractions or additions but not with this degree of accuracy except by chance.

This train of divide gears will index 113.00073 teeth, and in our original problem the total error would be 0.00073 × 1.0472 = 0.00076 inches or less than one-thousandth of an inch which may be considered as being fairly accurate. However, there is reason to believe that other trains exist which have the same degree of accuracy and possibly there are one or two which are even more accurate.

It should be added here that the chances of finding suitable factors in solving these problems is greatest with numbers lying between 1500 and 3500. There is a definite mathematical reason for this which need not be given here. I would suggest to those interested that they work out for their own satisfaction and instruction a solution for some other odd number of teeth. This will demonstrate the simplicity of the method.

NEW BOOKS . . . . . .

POLICY AND ETHICS IN BUSINESS.—*By Carl F. Taeusch, Managing Editor, "Harvard Business Review," associate professor of business ethics. Harvard University. 624 pages, 5⅞x9 in. Indexed. Clothboard binding. Published by the McGraw-Hill Book Co., Inc., 370 Seventh Ave., New York, N. Y. Price $5.00.*

Any study into so intangible a phase of human behavior as ethics must take cognizance of those basic characteristics of a people that define the conception of right and wrong. Such influences as climate, physical characteristics of the land, government, religion, and social ideals are closely interwoven with this subject. In short, business ethics is but a special branch of the broader field of personal ethics and must be treated in that light.

The author's proper evaluation of these factors is reflected in his treatment of the opening chapters. He then passes on to the more concrete forces that shape our business structure, as for instance, the Sherman Law with its changing interpretations. He describes some of the phenomena of business as we know it today with its mergers, trade associations, and full-line forcing. Price policies are examined with their oft-repeated problems of discrimination, price cutting, reciprocal buying, and competitive bids.

While warning against confusing the general subject of ethics with the particular part of it dealing with trade abuses, Prof. Taeusch enumerates these abuses and illustrates them with examples taken largely from Federal Trade Commission reports. Piracy, misrepresentation, bribery, espionage, misleading advertising are all carefully scrutinized. The difficulties of controlling these vexatious tactics, either through the courts or through the Federal Trade Commission, is pointed out. Often time is the essence of the injury to a legitimate manufacture, and delay neutralizes the ultimate attempt at remedy. Self-regulation appears to be the most promising solution. Legalization of commercial arbitration is a step in the right direction but entails the risk of rigid statutory regulation that may curtail the desired flexibility.

The volume is well arranged and interestingly presented. Executives in many harassed industries will find its contents worth their attention.

MECHANICAL DRAWING, BOOK III—*By Horace E. Boggy, head of drafting department, Herman Z. Denzler and H. Harold Walter, instructors, Arsenal Technical Schools, Indianapolis. 22 pages, 8½x11 in. Paper covers. Published by the McGraw-Hill Book Co., Inc., 370 Seventh Ave., New York, N. Y. Price 60 cents.*

Third in the series of mechanical drawing problem texts, this one contains groups of practical applied drawing problems, principally on screw threads and shaft keys. Four problems are incorporated in group, each the same in principle, but graduated as to difficulty, thus permitting assignment according to ability. The text is flexible and usable, and should prove of value after a preliminary course in drawing has been given. The book gives the work of third-semester mechanical drawing.

HENLEY'S TWENTIETH CENTURY BOOK OF RECIPES, FORMULAS, AND PROCESSES. (REVISED EDITION)—*Edited by Gardner D. Hiscox. 800 pages. 6x9 in. Illustrated. Indexed. Clothboard covers. Published by The Norman W. Henley Publishing Company, 2 West 45th Street, New York, N. Y. Price, $4.00.*

A standard popular reference book for many years, this new and revised edition is brought up-to-date by the addition of new formulas, processes, and a chapter on laboratory methods. Much of the material is popular in tone and of service only to the householder, but the book contains a wealth of material that should be useful in the shop. There are in all ten thousand formulas and recipes in the volume including such varied material as adhesives, alloys, cements, ceramics, metals, glazes, varnishes, plating, paints, soldering, and lubricants.

MECHANISM. THIRD EDITION.—*By Robert McArdle Keown, engineer, Industrial Commission of Wisconsin. Revised by Virgil Moring Faires, professor of mechanical engineering, Agricultural and Mechanical College of Texas. 242 pages, 5½x8 in. Clothboard covers. Published by the McGraw-Hill Book Co., Inc., 370 Seventh Ave., New York, N. Y. Price $2.50.*

Written in a simple understandable manner, and avoiding the more intricate phases of the subject, this third edition of a well-known college textbook is a distinct improvement upon the second edition. Much has been gained by the free use of photographic reproductions of actual machines and mechanisms embodying the principles set forth in the text. Of particular interest to machine shop production men are the chapters on gearing, one chapter being entirely devoted to methods used for generating different types of gear teeth.

One who has never studied the subject will find this book quite easy to understand and may profitably use it as preparation for further studies with advanced texts

QUANTITY AND ECONOMY IN MANUFACTURE—*By Fairfield E. Raymond, assistant professor of industrial research, Massachusetts Institute of Technology. 375 pages, 6x9 in. Clothboard covers. Published by the McGraw-Hill Book Co., Inc., 370 Seventh Ave., New York, N. Y. Price $4.00.*

In this book Professor Raymond undertakes to eliminate guesswork regarding the most important factor in manufacturing management, that of economic manufacturing quantities. To do this he separates the constants from the variables and provides an equation for each. It is not a book to be read at one sitting, neither can it be reviewed in detail because of the technical matter it contains.

The author has attempted to simplify his equations, but is quite probable that the involved mathematics will prove puzzling to many of those who are responsible for the manufacturing end of economic quantities. The author recognizes this tendency and ascribes it to resistance to mathematical technique, but it is more probable that these men are practical minded and visualize their specific problems in terms of concrete facts. Otherwise the book is exceptionally clear. It is sub-titled almost in terms of paragraphs, indexed in great detail and covers the subject thoroughly.

Ideas from PRACTICAL MEN

Safety-Type Test Weights

CARL E. SCHIRMER

When the chains of hoists, cranes, or other types of material-handling equipment are to be tested, it is desirable to have test weights that can be easily and safely handled. In testing our chains, 100-lb. weights were chosen for tests up to and including two tons as being not too heavy to handle, and furthermore they are easily-remembered units when assembling them for a definite total weight for a specific test.

The weights are 18 in. in diameter, as shown in Fig. 1, and are piled on top of one another, being carried by the eyerod, Fig. 2. It will be noted that each weight has a slot running from the edge to the center to permit its being centered on the eyerod. A ½-in. projection, 5 in. in diameter, is cast on the top of each weight and a corresponding pocket, 6 in. in diameter, is cast in the bottom. The purpose of these projections and pockets is to prevent the several weights from slipping off of one another when stacked. To enable each weight to be handled quickly and easily, and to provide for a good grip, even when it is lying on the floor, two pockets are cast in diametrically opposite edges. For tests up to and including one ton, the weights are stacked in a single pile. For tests up to and including two tons, the weights are stacked in two piles, as shown in Fig. 3. Two eyerods are used in connection with an equalizing bar having an elongated hole in the center for the crane hook.

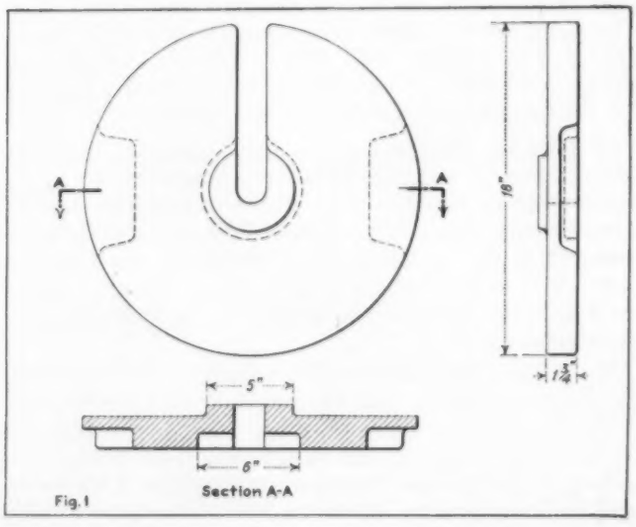


Fig. 1

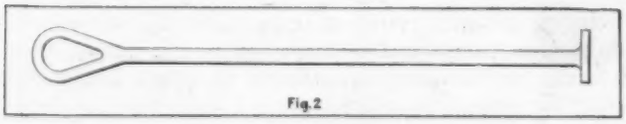


Fig. 2

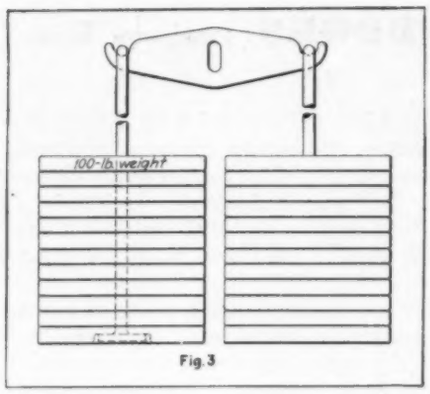


Fig. 3

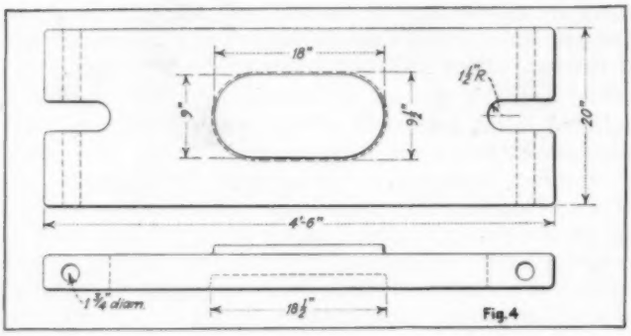


Fig. 4

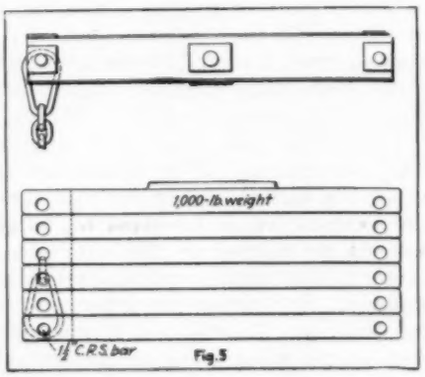


Fig. 5

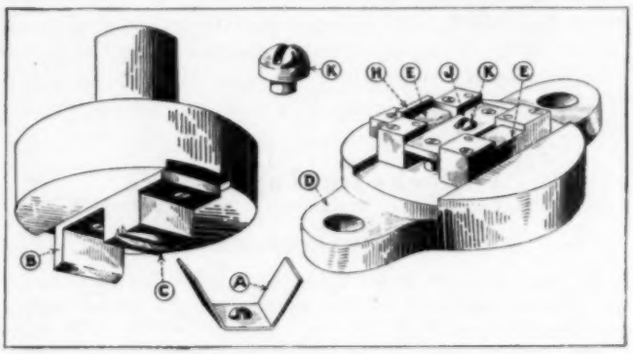
For loads of more than two tons, the rectangular weights to be seen in Fig. 4 are used, each one weighing one-half ton. These weights have the same provisions to prevent them from falling off of one another as in the case of the lighter weights. The half-ton weights each have 1¾-in. holes cored crosswise at the ends, into which holes in the bottom weight of the pile, cold-rolled steel bars are inserted, as in Fig. 5. Open slots, 3 in. in width, are provided at the ends of the weights for inserting chain slings having large links at the ends to pass over the steel bars.

This arrangement permits any number of weights to be stacked and lifted by first inserting the steel bars through the holes in the bottom weight and through the large links at the lower ends of the slings. The slings are suspended from a spreader beam consisting of two channels joined by short cover plates. A pin through the center of the spreader beam provides means for attaching the crane hook.

Multiple-Action Press Tools

CHARLES H. WILLEY
Superintendent of Manufacturing,
Hoyt Electrical Instrument Works

Here is another set of simple press tools that performs several operations at one stroke of the press. The parts, one of which is shown at *A*, were made of $\frac{1}{16}$ x $\frac{1}{2}$-in. cold-rolled strip steel and were required in lots of 50,000. The work to be performed is that of cutting off, forming, and



piercing part way, leaving two-half-conical stops projecting.

Section *B* of the punch does the cutting off, while section *C* does the forming and piercing. The die is shown at *D*. The stock is fed across the guide *E* and against the stop *H*. When the punch descends, the first action is that of cutting and forming, the shear blade *B* being just enough in advance of the section *C* to complete the cutting at the time section *C* has met the stock. Continued downward movement of the ram causes the pressure plate *J* to be driven down by the stock, permitting the ends of the blank to be bent upward by the edges of the guide sections.

By the time the pressure plate has come to rest at the bottom of the stroke, the punch *K*, which is conical and is slotted through its center, has partly pierced the stock and has formed the two half-conical stops. An enlarged view of the punch *K* can be seen in the center of the illustration. The pressure plate is held up by a rubber buffer located below the die.

Drawing Hard Brass

QUESTION: We have been called upon to make a quantity of small parts, like the sample, of $\frac{3}{8}$ x 0.015 in. brass. We are trying to form them in five operations but are having trouble in doing so. We find that in reducing the cup the "heads," as we call them, split in a horizontal plane, right under the top.

It is necessary to use quarter-hard brass, so we can get no relief by annealing. But inasmuch as we are reducing the metal instead of stretching it, we cannot see why the metal should split. Can you suggest a remedy?

ANSWER BY C. W. HINMAN, *Chief Tool Designer Kobzy Tool Company.* The first and second operations are of such shape that the metal around the apex must be drawn three times, including the final drawing. At this point, the metal is hardened by the previous operations and becomes crystalized. To prevent this, I suggest that the punches for the first two operations be made cone shaped instead of dome shaped. The same rule applies in this case as with most drawing operations. The bottom of the cup should be made the same size as the finished diameter of the cup, otherwise draw wrinkles, caused by the bend where the side joins the bottom, will appear on the finished cup. If the point of the punch is made the diameter of the finished "head" the trouble will disappear.

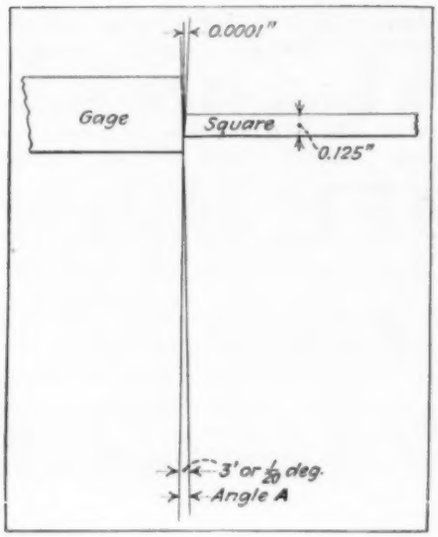
Making and Checking a Flat Square
Discussion

JOHN J. MCHENRY

In an article under the title given above (*AM*—Vol. 75, page 250), Wm. Butzlaff criticises the method described by me (Vol. 74, page 765). Had Mr. Butzlaff contributed his opinion as an additional method, rather than as a better method, it would have been evident that he had given the subject some thought. While it is true that we had everything necessary to make a permanent fixture, we did not need a permanent fixture because there was but one square to be checked, and there was little likelihood that the fixture would be needed for future use.

However, this angle of consideration has no bearing in this instance, the fact being that the device described by my critic is not as good as the one used by me. Had the square been equipped with a heavy stock, enabling it to stand without support, that might have been a factor in favor of Mr. Butzlaff's fixture. Or had the square a knife-edge, I would have made a similar fixture, for then its need would have been evident. But, as I stated in my article, my square was flat and $\frac{1}{8}$ in. thick.

It is true that an opening less than 0.0001 in. is easily detected by light shining through it, when one unit has a knife-edge. It is equally true that as the faces in contact become wider, the detection of error by light is not only difficult but uncertain. There is a confusion and a contradiction as to whether or not the light filters through, and where. One reason for this is plainly evident where an opening of 0.0001 in. between two pieces (one of them having a thickness of $\frac{1}{8}$ in.) exists. By finding angle *A*, as indicated in the sketch, the minute angle (less than 1/20 of a deg.) is all that is



required to shut out light totally, and only those who have tried it can testify to the eye-strain and headache resulting from attempting to keep the line of vision in a plane with the flat surfaces they are attempting to sight through.

Another reason for failure to see light through minute openings between flat surfaces is the greasy film that is on every piece we handle, and which can be removed by chemical means only. This film readily contacts between flat surfaces and eliminates the sight method as a practical means of checking one flat surface against another. I realize that this last statement can be twisted into further criticism by the introduction of optical flats into the discussion. By means of optical flats, two flat surfaces of any width may be brought into contact and by reason of interference bands of light, a reading close to 0.000001 in. can be obtained. However, while I am familiar with this method and also with the production of such surfaces, the original intention of my article was one of circulating a practical method of doing a difficult job in the average-equipped toolroom.

In another part of Mr. Butzlaff's criticism, he says, "Moving the square so that its blade is against the opposite edge of the parallel, any error in the square will appear doubled." Well, is this not also true in the device described by me? And lastly, there are at least two indicators on the market that will read to "tenths" and then split them up into sections.

I would like to call Mr. Butzlaff's attention to an article entitled, "Making Accurate Squares for Gage-makers," which I wrote under the name of John Teckneer (*AM*—Vol. 48, page 1041). As I remember it, the sight method was quite thoroughly covered in that article.

Freeing a Chill Mandrel

JAMES MC INTOSH

In discussing the article by Stanley Pivonski, "Removing a Jammed Setscrew" (*AM*—Vol. 73, page 366), J. T. Towlson (Vol. 74, page 256) goes on to tell how he removed a "frozen" hammer head from the broken piston rod of a steam hammer. His method of heating the hammer head to expand it is certainly superior to heating it by an oxyacetylene torch, by the use of which local heating and heat dissipation would take place and heat the rod.

I recall a job in which it was desired to chill the hole in a heavy ring of cast iron. The foundry foreman said, "We can chill the hole O.K." So a mandrel was made to act as a chill, and was provided with an eyebolt for ease in handling. After the metal had been cast around the mandrel and had been removed from the mold, it was found that it had shrunk tightly on the mandrel and all efforts to separate the two resulted in failure. The foreman said, "Let it go and I will show you how to remove the mandrel without striking a single blow."

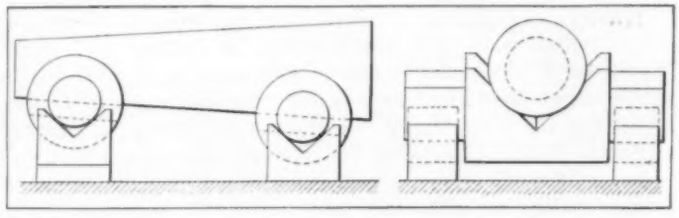
He bedded the ring in the sand floor and dug the sand away so as to leave four spaces around the outside. Molten iron was poured in the spaces, heating the ring. A slight strain was put on the eyebolt by the crane, and when the heat had expanded the ring sufficiently, the mandrel popped out before it had time to expand. It follows that there is virtue in using common sense to solve problems.

V-Blocks for Taper Work

D. Q. DUNSTONE
Hetton le Hole, County Durham, England

Having occasion to set up tapered work for machining, the set-up indicated in the sketch proved to be simple and satisfactory.

The ends of two round bars were turned to a con-

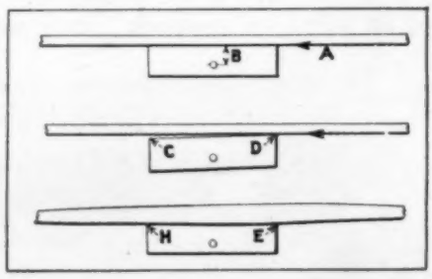


venient diameter, and V-s were cut across their centers. The turned-down ends of the bars were supported in V-blocks. In order to obtain proper alignment of the work, packing was inserted under one of the V-blocks. It will be seen that no matter how much one end of the work is raised by the packing, the V-s in the round bars will automatically align themselves with it. This method has the advantage of being applicable to work of any taper and diameter.

Filing Work Flat—*Discussion*

HARRY SHAW
Heywood, Lancashire, England

In an article under the title given above (*AM*—Vol. 74, page 767), Maurice Lambert describes a rather ingenious way of insuring that work will be filed flat. He has, however, forgotten to mention the two following points which are essential to his method: (1) that the pivot be in the same line as the top surface of the work, or slightly above it, and (2) that the file must be extremely flat.



If the pivot is not in the same line as that of the top of the work, but is located slightly below it, the force *A* (see sketch) tends to tilt the work around the center, because of the forward motion of the file, the amount of tilt depending upon the distance *B*. It is impossible, with this arrangement, to file off metal at *C*, for as soon as pressure is applied the work tends to move away. The pressure applied at *D* by the forward motion of the file tilts the work around the pivot. In this way, the work will be filed tapered.

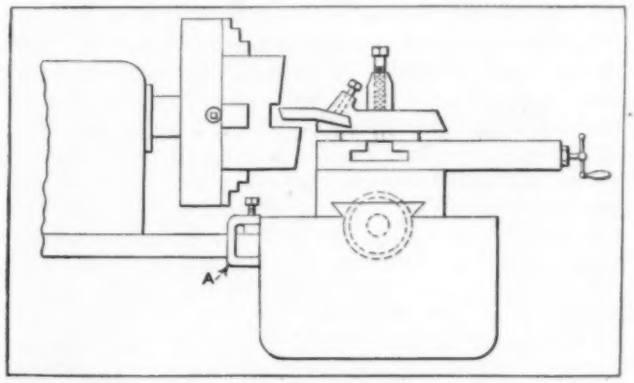
Should the file be slightly convex, as most files are, the work will be filed concave, for no pressure other than that caused by the forward motion of the file can be applied at *E* without the file also touching at *H*, and if the file is convex, the material between *H* and *E* must be concave for the file to be able to touch at both points

An Improvised Method of Making Helical Cams—*Discussion*

GEORGE ODUM

I was very much interested in the articles under the title given above by George Wilson and Charles Kugler (*AM*—Vol. 74, pages 365 and 803, respectively), and in the article by Ira S. Williams (Vol. 75, page 27). My method of cutting cams similar to the ones referred to in these articles is shown in the accompanying sketch.

The compound rest is set parallel with the lathe bed and is used to control the depth of cut, the cross-feed



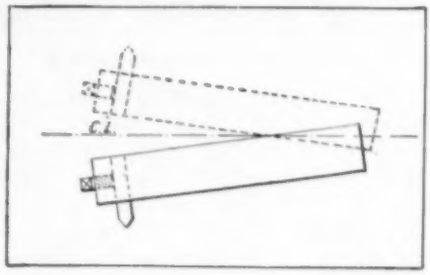
screw being used to regulate the feed. With the lathe geared for the correct lead, the nut is closed and the spindle is revolved until the clearance slot in the cam blank is opposite the tool, which is set to the same height as that of the centers. The block *A* is then clamped to the lathe bed and against the carriage. The first cut is then taken. After each cut, the lathe is stopped when the clearance slot is opposite the tool. The nut is opened and the carriage is moved back against the block *A*. At this position, the nut is closed, the tool is moved inward by the cross-feed screw and the lathe is started for the next cut.

After the spindle has made about three-fourths of a revolution, the clutch is released and the spindle is inched around until the clearance slot is again opposite the tool. This cycle is repeated until the cam is finished. After a few attempts, the operator will be able to make the cycle of movements without any trouble. It is best to start slowly and to speed up after becoming familiar with the job.

Setting Tools for Precision Boring *Discussion*

DONALD RAEBURN
Glasgow, Scotland

In his criticism of the method of setting a boring-bar cutter suggested by Ernest Foldvary in an article under the title given above (AM—Vol. 74, page 26), John Windon (Vol. 74, page 766) points out that with an unsupported bar it would be utterly impractical, as the slightest runout of the bar would throw everything out. With this statement we can all agree, but Mr. Foldvary made the requirements for accuracy quite clear by the qualification, "providing the boring machine is in good condition and the bar is properly adjusted in its bearings."



Unfortunately, there is a great deal of truth in Mr. Windon's statement that "Those who have had boring-bar experience have yet to see a true-running bar having an accurate surface." The boring bar is too often considered to be the least important part of the boring machine. However, the fact that true-running and accurately-surfaced bars are in everyday use is clearly proved by the advertising pages of the *American Machinist*. Also, the importance of obtaining and using the full equipment that the tool builder is prepared to supply, has been continually emphasized in that journal. The theory that skill is a substitute for good equipment does not hold true for today's requirements.

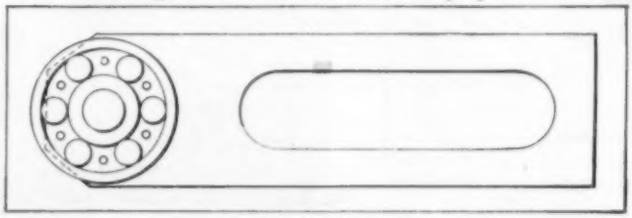
In setting the cutter in an unsupported bar, as outlined by Mr. Windon, he has taken precautions to insure accuracy in setting the tool, but should the bar run out, he has ignored the fact that the setting must be carried out in correct relation to the runout of the bar. In the accompanying sketch is shown a bar in which the runout is greatly exaggerated, the highest and lowest points being clearly defined. The correct setting position for the cutter is midway between these points.

Ball Bearings for the Steadyrest

CHARLES KAUFMANN

In supporting finished work in the steadyrest, undue friction may be created and the work badly scored where the jaws bear upon it. Friction, and the consequent danger of scoring the work, can be largely eliminated by attaching ball bearings to the jaws, as shown in the illustration.

The bearings are attached either by pins or bolts



through the central holes in the inner races and must be tight enough to prevent the inner races from revolving with the work. The outer races revolve on balls and on the work, converting them into roller bearings. Ball bearings for this purpose can be bought for about 65c. each at almost any store that carries automobile supplies and will soon save their cost by eliminating spoiled work.

Tools for Finishing Bearings of Locomotive Trailing Trucks

L. S. TAYLOR

The tools illustrated have been found very useful in finishing the white-metal linings in the shells of bearings used in the trailing trucks of locomotives. After the shells have been lined, they are placed in the fixture *A*, Fig. 1, where they are held by inclined setscrews. A strip attached to the fixture at *B* acts as a stop for the work. A forming tool of the same radius as that of the finished bearing, as at *C*, is used for machining the lining, the work being done in the planer.

After planing, it is necessary that the bearings be rounded at the ends to suit the fillets in the journals. For this operation, which is done in a drill press, the bearings are put in the fixture shown at *A* in Fig. 2. The head of the fixture is bored and bushed to receive a toolbar, and the front is machined to the same radius as that of the smallest bearing. For larger bearings, liners of different thicknesses are attached to the head, as at *B*. In the frame, just back of the head, is the pin *C* on which the clamp *D* is hooked.

In operation, a bearing is placed against the head of the fixture, the lower end resting upon a block of a height that will permit the end to extend below the head of the fixture. The clamp is then hooked on to the pin and is fastened by the screw *E*. The block is then removed from beneath the bearing. With the toolbar *H* in the spindle of the drill press, and passing through the bushing in the head of the fixture, the form tools *J* are put in their holes in the toolbar.

Feeding the spindle downward causes the upper tool to round the corners at the upper end of the bearing. Feeding the spindle upward causes the lower tool to round the corners at the lower end. About three minutes is required for the planing, while rounding the corners takes about the same amount of time.

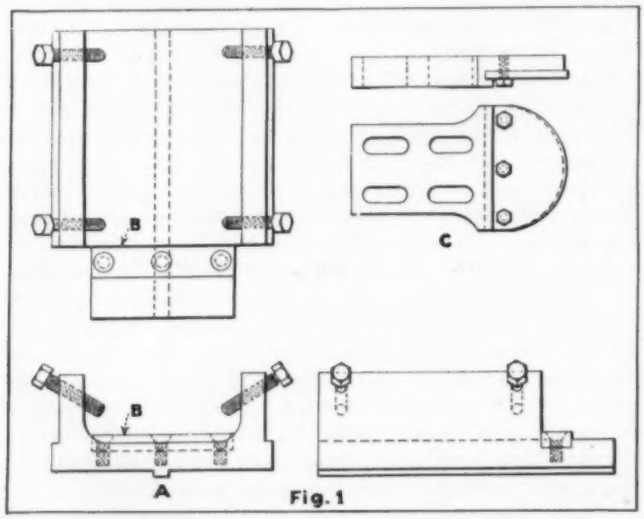


Fig. 1

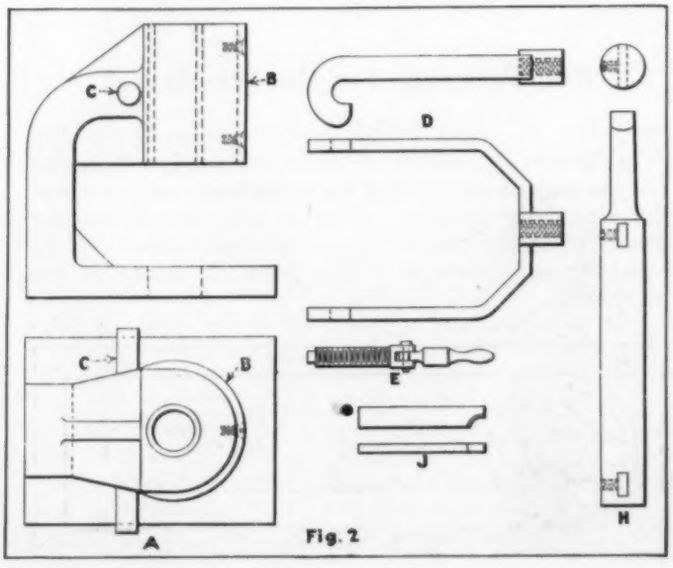


Fig. 2

SEEN AND HEARD

JOHN R. GODFREY

Carburizing Without Guesswork

Saving waste heat is a real source of economy. Some of the new automatic carburizing furnaces push the boxes out the same door they enter. In this way the outgoing boxes give up a lot of their heat to the incoming boxes and so save electric heating current. By regulating the speed of the conveyors the depth of case can be varied at will—in one instance 0.03, 0.04, 0.05 and 0.06 in. are standard depths and are maintained within 0.005 in. variation. Carburizing compounds are also mixed mechanically, both as to ingredients and the percentage of new material. The size of the grains of the carburizer is also controlled and the dust removed by a suction fan. Pyrometers and conveyors have taken the squinting and guesswork out of carburizing.

Jack-of-all-trades

A letter from John A. Tansley describes some of the troubles of the old time machinist as follows:

The machinist of 30 years ago, took a great deal of satisfaction in his job and prided himself on his ability to do good work. In those days, the various industrial plants did not have their own machine shops and tool rooms, as they have today, but had all their work done in job shops. The mechanic never knew what he would be called upon to do next and did not care. He was subject to call at any time, day or night, to go out and make repairs. It made no difference to him whether it was setting valves on a steam engine, babbitting a crank shaft, or repairing a paper mill machine, a printing press, a water wheel, or perhaps pumping machinery. They were all machines to him, and for the most part, he did the work satisfactorily.

SHOP EQUIPMENT NEWS

Norton Automatic Cam Grinder

Automatic cam grinders in three sizes for 36-, 42- and 48-in. camshafts have been developed by the Norton Co., Worcester, Mass. With this machine cam contours are ground essentially in the same manner as with the cam grinding attachment which has until recently been standard equipment in the automotive industry. It is offered only where internal-combustion motors are built in sufficient quantities to permit continual operation.

The various functions of cam grinding are performed automatically, most of them hydraulically, accurately, rapidly and without an attendant touching the machine after the cycle has been started. Because of these automatic features, it is now possible for one operator to run three or four machines.

After a camshaft has been placed in the machine, the grinding operation is started by pressing an electric push button. This, the only action required by the operator, actuates solenoids, one of which operates the valve controlling the table movement, and the other the work drive clutch. As the table moves so that the first cam to be ground is opposite the grinding wheel, another clutch is automatically engaged to start the grinding cycle. Three cycle speeds are available.

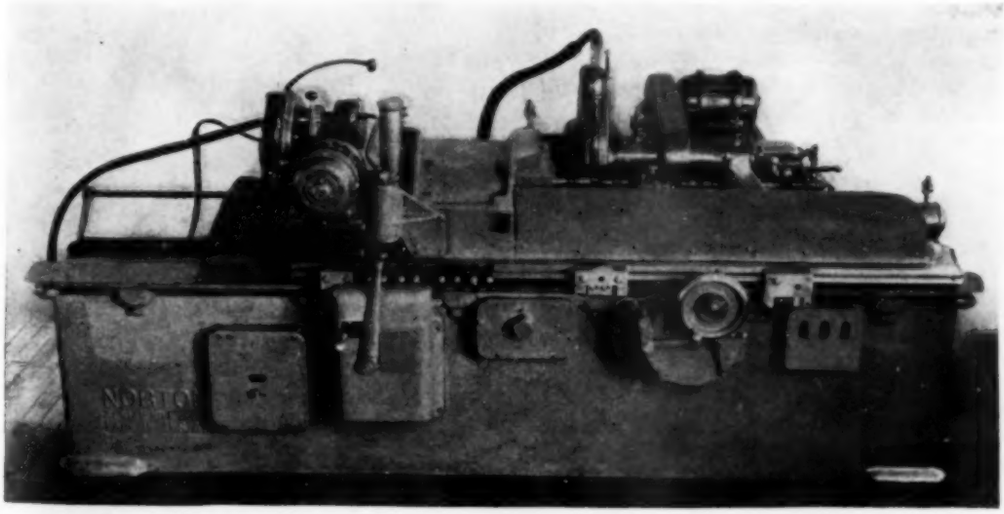
As the wheel slide moves forward to grind the first cam, the master cam roller is brought in contact with the correct master cam, and a table stop lever is tripped, positioning it for the next indexing of the table. After the first cam is ground the wheel slide moves to its rearmost position, and the master cam and master cam roller are disengaged. Simultaneously, the table moves to the second grinding position, the master cam roller to the corresponding master cam, and these functions repeated.

Successive cams along the shaft are ground in the same manner until the last cam is ground and the wheel slide reaches the rear position. The table then moves to the truing position, and a predetermined, but adjustable, truing speed is automatically brought into action. One pass of the diamond is made across the face of the grinding wheel, and as the table carrying the diamond reverses, the work speed is automatically reduced for a finishing speed. A second pass of the diamond across the wheel is made, after which the table continues to move, positioning the work, so that the last cam ground is in front of the grinding wheel ready for finish grinding. Each successive cam is then finish ground in a similar manner to the rough grinding operation until the wheel slide reaches its rear position after finishing the last cam, when the table moves to the loading position, the work revolution automatically stops and the clutch is disengaged, stopping the entire cycle.

The operator then replaces the ground shaft with another and starts the cycle again. If desired, the machine can be used for roughing or finishing only, and in this case the cycle is arranged so that the machine stops when one pass of the table is completed in either direction.

The machine is motor driven, three motors being required for its operation. A 3- or 5-hp., 1,800 r.p.m., constant-speed motor is mounted on the wheel slide and drives the grinding wheel. A 1-hp., 1,200 r.p.m., constant-speed motor is mounted on the table and drives the work, while a third, which is a 5-hp., 1,200 r.p.m., constant-speed motor, is mounted at the rear of the base and is directly connected to the lubricant pump and also drives the backshaft from which the hydraulic pump and the cycle mechanism obtain power.

Bases for all lengths of machines are single castings arranged to rest on three points. The table also is a single casting, on which are mounted the rocking bar, the diamond tool holder and the bracket which supports the master cam roller



Front view of Norton Automatic Cam Grinder from a slightly elevated position to show the work

and the work drive mechanism. The table is indexed hydraulically by means of a cylinder and piston. Trip dogs carried in a T-slot at the front of the machine position the table for grinding each cam.

The hardened steel master cams are exceptionally wide and are made from blanks 6 in. in diameter, thus assuring minimum wear. The master cam spindle is of large diameter and carries an unusually large work center. The rocking bar is of cast iron with heavily trussed cross-section, and a dovetailed section on the upper side provides means for clamping steadyrests and the footstock. The roll bracket bridges the rocking bar and is fastened to the table. The hardened steel master cam roll is mounted on a large diameter shaft supported at both ends in adjustable ball bearings.

The wheel-slide unit moves on two V-ways which are lubricated by automatic sight-feed oilers. The wheel spindle runs in large bronze boxes tapered on the outside to provide for adjustment. The bearings are flood lubricated by a gear pump driven directly from the spindle itself, and a reciprocating attachment which operates while grinding, but stops automatically for the truing operation, is provided.

Master cams can be furnished for use with grinding wheels from 24 to 22 in. in diameter or from 22 to 20 in. in diameter. In this way a grinding wheel worn to a discard diameter of 22 in. in one machine can be transferred to another and used to 20 in. in diameter without the loss of contour accuracy.

Hydraulic feed is provided for moving the wheel rapidly to the grinding position and slowly during the actual grinding, the change from one speed to the other being entirely automatic. For truing, an adjustable mechanical feed is employed which is independent of the hydraulic feed. This mechanical feed is operated through a large feed screw and adjustable half-nut. A graduated hand wheel provides for manual feed when desired.

When grinding, the wheel slide rests against a stop, thus positively duplicating the location of the grinding wheel for each cam. Two stops are provided, one for roughing and one for finishing, a change from one to the other being automatically controlled between the rough and finish grinding operations as one of the functions of the automatic cycle.

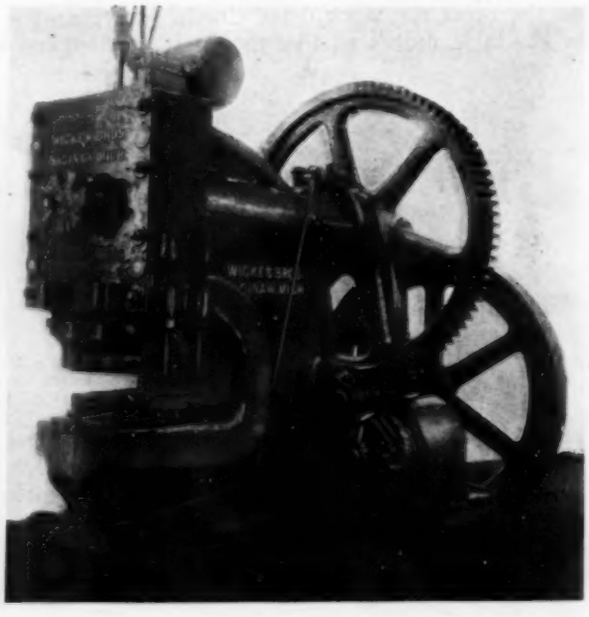
All the hydraulic valves are of the balanced type and all cylinders are located in the base so that any leakage of oil will return to the oil reservoir. Wherever possible, all oil pipes are concealed, but are accessible.

The machine is made in three lengths to take camshafts 36, 42 and 48 in. between centers. The 36 in. machine weighs approximately 12,000 pounds net, including standard equipments and motors.

Wickes No. 12 Heavy-Duty Vertical Punch and Shear

For shearing 4½-in. round steel bars, 1½x16-in. flat steel and other structural shapes of equivalent area, Wickes Bros., Saginaw, Mich., have developed the No. 12 heavy-duty vertical punch and shear. This machine has a capacity of 500 tons applied pressure, a 5-in. stroke of the ram, and a 24-in. depth of throat. The main punch body is a steel casting. All gears are of steel with teeth cut from the solid, except the motor pinion which is of rawhide with bronze shrouding. All bearings throughout are of bronze.

The ram is of steel with bronze bearing surfaces in the punch body. It is provided with an adjustable counterweight for balancing the various types of punching and shearing tools attached. The clutch is provided with an adjustable automatic stop attachment, which allows the ram to be brought to rest at any desired point. The cam ring of the clutch is cast integral with the body of the sliding clutch member, adjustment being provided by varying the position of the pull-out roller lengthwise of the shaft. By this simple adjustment it is possible to set quickly and easily the position at which the ram, punching or shearing tools shall be brought to rest. A treadle is provided so that the clutch may be engaged and disengaged at will. This type of machine is also built with an electrically operated clutch through a solenoid and push-button station. The machine is arranged for direct motor drive through a 25-hp. punch-press type of motor. The net weight of the machine without the drive motor and electrical control is 54,800 lb.



"Industrial" Electro-Deposited Sheet Copper

The Industrial Development Corp., 50 Congress Street, Boston, Mass., announces it is manufacturing electro-deposited sheet copper in coils 60 in. wide by any length desired, and in gages down to 0.002 in. Being the product of an electrolytic cell, the chemical purity of this sheet is very high. Its physical properties are claimed to be equal or superior to those of rolled copper, with the further advantage to the customer in that there is no directional grain structure and therefore the tensile strength and elongation are uniform when tested either lengthwise or crosswise of the sheet. The metal is

uniform in gage, and the maximum tolerance is plus or minus 0.00025 in. throughout the length of a sheet 0.005 in. thick. In appearance the copper is similar to a polished rolled sheet on one side, and the other side has the characteristic salmon pink color of pure electrolytic copper.

McNeil Model M Series Flexible-Shaft Machines

Two universally applicable flexible-shaft machines have been announced by The McNeil Brothers Co., Cincinnati, Ohio. Although not shown, a high-speed attachment can be installed on this machine to make possible six speeds from 875 to 10,500 r.p.m. This high-speed attachment

may be kept on the machine as a permanent attachment and when so attached makes it a two-shaft machine.

Without the high-speed attachment the machines provide three speeds. The hand piece may be fitted with Timken roller bearings or with ball bearings. Drive from the motor to the shaft is by means of a cone pulley and V-belt. The motor plate rests on a 5-in. ball bearing race which swivels for the full 360 deg. A switch is attached to the motor plate for convenient use by the operator. A heavy motor support and column are provided. Vibration of the base is reduced by making it heavy, the weight being 65 lb. Three-inch heavy-duty double swivel casters permit easy portability.

The Model M-2 machine is provided with a ½-hp. ball bearing motor, and has speeds of 875, 1,750 and 3,500 r.p.m. The shaft is ½ in. by 7 ft. The Model M-4 is equipped with a 1-hp. motor, has the same speed range, but has a ⅝-in. by 7-ft. shaft. A full range of hand pieces, form filing tools, toolholders, drill chucks, wire brushes, right-angle drive attachments, rasping tools, polishing pads, and grinding wheels are available.

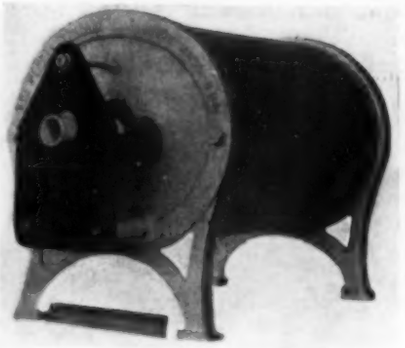
Sun Veneer Composite Rustless Steel

The Superior Steel Corp., Grant Bldg., Pittsburgh, Pa., is manufacturing strip steel consisting of a carbon-steel base to which is veneered a thin covering of 16 to 18 per cent chromium steel or 18 per cent chromium, 8 per cent nickel steel. The corrosion-resisting veneer may be 10 to 20 per cent of the thickness of the composite metal, and may be had on one or both sides. The base is 80 to 90 per cent carbon steel. The resultant product can be drawn or formed into any part now made from other metals, and the exposed surface is permanently bright after initial polishing. In a great number of applications where solid rust-resisting materials are not required a considerable saving can be effected by using this material.

Sun Veneer has sufficient thickness of rustless metal to resist denting, scratching and corrosion. Tests have shown that the veneer will not separate from the base metal. Representative products for which the material has been used are bumpers, automobile lamps, panels, leaders and gutters.

Sentry Model V High-Temperature Tube Furnace

A small electric tube furnace for laboratory use has been developed by the Sentry Co., Taunton, Mass. Like the larger model U furnace described on p. 495, Vol. 73, this furnace will give a maximum temperature of 1,400 deg. C. (2,252 deg. F.). It may also be used for small tool hardening.

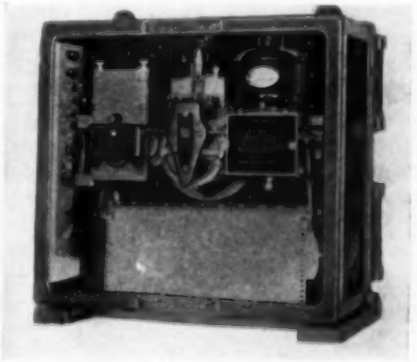


Sentry Model V Tube Furnace for temperatures to 2,250 deg. F.

The special porcelain tube has a 1-in. bore and has an 8 in. heated portion. The tube itself is 24 in. long and extends out from the front of the furnace sufficiently so the end is cool enough to handle. The heating elements are of silicon carbide, and terminals are air-cooled. A thermocouple hole ½ in. diam. is provided in the heating chamber so that a pyrometer can be used to determine the furnace temperature. A rheostat permits close control of the rate of heating. The electrical supply should be 110 volts a.c. or d.c., and the maximum demand is 2½ kw.

"Micromax" Potentiometer Pyrometer

Micrometer sensitivity, automatic standardization, and rapid recording are features of the "Micromax" potentiometer pyrometer announced by the Leeds & Northrup Co., 4901 Stenton Ave., Philadelphia, Pa. This improved instrument requires no manual adjustments, and it needs no daily attention. The instrument circuit is standardized automatically every 45 min. or less, giving a closer



adjustment than is obtained manually. Manual adjustment of the stepping action is no longer necessary.

By virtue of the microscopically sensitive balancing device employed, the Micromax pyrometer can detect and record deflections of the galvanometer pointer amounting to 0.001 in. This sensitivity makes the recorder action responsive and speedy, sending the pen, or print wheel, across the chart paper in steps that are much more accurately proportionate to the temperature change. If necessary, the recording pen, or print wheel, can step across the entire chart in less than 22 seconds, the size of each step being closely related to the extent of galvanometer pointer deflection. This rapid recording feature is of value especially in automatic control and where more than one temperature is being measured.

Oilgear "Streamline" Presses

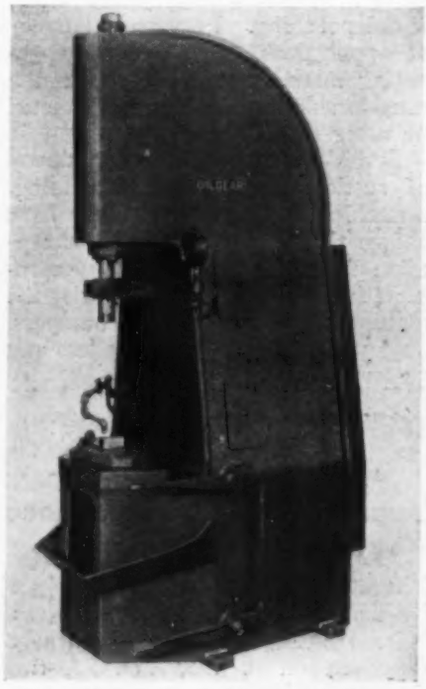
Compact neat design is featured in the "Streamline" presses developed by The Oilgear Co., 647-683 Park St., Milwaukee. Wis., for production work. The entire operating mechanism, including the Oilgear pump, electric motor, lubricating pump, piping and controls are inclosed in the frame structure with convenient space for adjustments. The presses may be equipped with either variable-delivery, constant-pressure or constant-displacement Oilgear pumps and suitable controls. Thus, satisfactory operating characteristics are available as best adapted for assembling, broaching, forging and general manufacturing operations.

The accompanying illustration shows the front and side elevation of a six-ton press. The press frame is a one-piece heavy welded steel structure. A welded steel guard covers the rear portion of the frame. Press cylinder tube is honed, and the piston and piston rings are fitted in place, and the ground and polished ram is guided in the front head. Special molded ram packing eliminates leakage. A gage registers the working pressure.

Both a handwheel and a pedal with semi-automatic or full automatic contorls are furnished as standard equipment in connection with either the variable-delivery, constant-pressure or constant-displacement pumps. Any required ram speed within the capacity of the machine can be obtained by motion of the hand lever or pedal when using a variable-delivery pump and a semi-automatic control. The ram can be started or reversed instantly, and the control is arranged with adjustable-stroke limiting dogs. The full-automatic control permits continuous ram notion through any desired stroke. Ram motion can be started and stopped at the will of the operator.

When using a constant-pressure pump the press can be stalled and maximum pressure held continuously without overheating and loss of power. Ram speed can be varied to suit by means of a convenient external adjusting screw. When using a constant-displacement pump the ram speed is constant and the top and bottom limits of ram travel are adjustable. The cycle of operation can be interrupted at will by means of the lever or pedal.

Standard equipment consists of the handwheel and pedal control with adjustable-stroke limit dogs, control valve, automatic air drain valve, pressure gage, gage protector, piping, Oilgear pump with pulley, adjustable motor bracket and rear guard. Extra equipment includes the motor drive, coolant pump and piping, shuttle cylinder and additional stroke or daylight space.



Oilgear 6-Ton "Streamline" Press, which has an 18-in. stroke

Streamline presses are manufactured in the following capacities: 2½, 3½, 6, 10, and 15 tons. General specifications are as follows: stroke, 18 in.; daylight, 24 in.; depth of throat, 8 in.; size of platen, 10x13 in.; hole in platen, 4 in.; height of platen from floor, 20½ in.; total height, 102 in.; floor space, 35½x43 in., and net weight, 4,100 lb.

Oxweld Welding Rod Markings

The Linde Air Products Company, 30 East 42nd Street, New York, N. Y., has announced a new standardized set of markings on all Oxweld welding rods. With three exceptions, all rods ⅛ in. in diameter and larger are stamped with the name "Oxweld" as well as the number and type of rod. On the smaller sizes of welding rod where it is not possible to stamp the name, the boxes in which the rod is shipped are plainly marked "Oxweld" with the number and type.

Oxweld No. 1 high test patented steel rod, marked "Oxweld No. 1 H. T. Patented," is for use wherever welds of uniform high strength are required in steel plate, sheets, structural shapes, pipe, steel castings, etc.

Oxweld No. 2 high-carbon steel rod, marked "Oxweld No. 2 Steel," is for use when welding high carbon steel. For cold rolled shafting, or nickel or chrome steel, Oxweld No. 3 nickel steel rod marked, "Oxweld No. 3 Steel," is the proper welding rod. For manganese steel welding there is the Oxweld No. 4 manganese steel rod. The ends of each rod are painted green for proper identification.

Copper-coated Oxweld No. 7 drawn iron rods, for welding steel plate, sheet, structural shapes and pipe are marked "Oxweld No. 7."

Oxweld No. 9 cast iron alloy rods, which are for use when welding gray iron castings, are marked "Oxweld C.I."

There are nine different non-ferrous welding rods. For high strength welds in copper, brass or bronze, or for bronze-welding malleable iron, steel or cast iron, there are the non-fuming Oxweld No. 21 H. S. (high strength) patented bronze rods, which are marked "Oxweld No. 21 H. S. Bronze Patented."

For bronze-welding cast iron and for welding brass, bronze, etc., there are also the Oxweld No. 10 bronze rods, which are marked "Oxweld No. 10 Bronze"; and Oxweld No. 11 drawn manganese bronze rod, stamped "Oxweld Manganese Bronze." Oxweld No. 13 drawn brass rods, used on sheet or cast brass, are all stamped "Oxweld Brass." For rail bonding and metal furniture manufacture there is the Oxweld No. 19 cupro rod, which is marked "Oxweld Cupro."

There are three different types of aluminum welding rods. For sheet aluminum work there is the Oxweld No. 14 drawn aluminum rod. These are not marked. The box, however, is stamped "Oxweld." For aluminum castings there is the Oxweld No. 15 Lynite aluminum rod, marked "Oxweld Lynite." And for cast and sheet aluminum and aluminum alloys there is the Oxweld No. 23 aluminum rod, which is labeled "Oxweld No. 23 Aluminum."

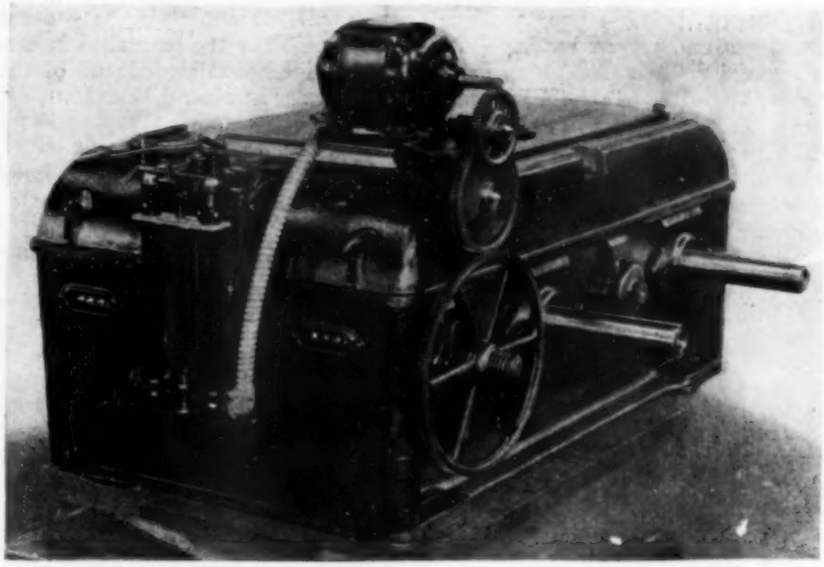
Reeves Variable-Speed Transmission with Automatic Electric Control

The design of the Reeves automatic electric control for automatic speed regulation of production machinery has been recently improved, according to the Reeves Pulley Co., Columbus, Ind. The electric automatic control consists of a fractional-horsepower motor of the reversible-pilot type, mounted on a bracket above the speed shifting screw of the standard Reeves variable-speed transmission. It is connected to this screw by spur gears. The motor is energized to run in either clockwise or counterclockwise direction by an automatic control switch incorporating special inclosed contactors or tubes.

Rheostat tubes of the compression graphite-disk type now replace the mercury tubes formerly used. These tubes permit the motor shaft to rotate slowly, thereby providing steady, infinite, highly sensitive speed variation, rather than step changes only. A movable fulcrum is connected to an extended lever, the slightest movement of which forms contact to increase or decrease the speed. This fulcrum is also connected by a short lever to one of the shifting levers of the transmission. When contact is made, movement of the shifting lever immediately changes the position of the fulcrum on which the contactors are located so that they are brought back to neutral position.

The rheostat tube is virtually a self-locking device in that if the transmission tends to seek a different speed of its own accord, the neutralizing lever compresses the proper rheostat to back it up to its original position.

This control is available for any voltage up to and including 250 volts d.c. or 550 volts a.c., and in any frequency. Motors furnished are single-phase, and only one phase of a two- or three-phase current supply is used.



The housings have been removed from the automatic electric control unit and the gear train to the Reeves Variable-Speed Transmission. The two tubes are compression graphite-disk rheostats that afford infinite variation in speed over the range provided

"Economo" Low-Carbon Machinery Steel

An 0.18 carbon molybdenum alloy machinery steel has been placed on the market by Wheelock, Lovejoy & Co., Inc., Cambridge, Mass., under the trade name of "Economo." The machining qualities are excellent, and the chemical analysis produces free and crisp cutting qualities. The steel may be used as a general-purpose machinery steel in the natural condition or casehardened. Sizes carried in warehouse stock range from ½ to 8 in., and any size, shape or finish can be rolled or forged. The steel is offered for such parts as casehardened gears, worms, pinions, sprockets, clutches, spindles, chucks, ball races, arbors, cams, camshafts, pins, gages, setscrews, dieheads and shafts.

"Cro-Tung" Corrosion and Heat-Resistant Steel

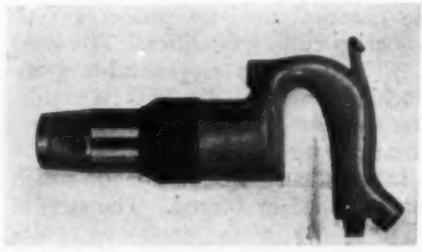
A steel known as "Cro-Tung" is being offered by Industrial Steels, Inc., Cambridge, Mass., for oil refinery service, steam power plant service, chemical industries, smelting and refining industries, or for any high-pressure, high-temperature, corrosion-resisting application. This steel has in a marked degree the physical properties of 18-8 chrome-nickel steel alloy, but exceeds the latter in remaining stable to 1,500 deg. F., with no brittleness range, and possessing a higher ductility at equal strength. The cost is lower. The steel is being furnished in bars, sheets, plates, forgings, tubes, cast-

ings, shapes, bolts, studs, welding rods, rivets and return bends.

The analysis of Cro-Tung is as follows: Carbon, 0.15-0.25; manganese, 0.55 maximum; silicon, 0.55 maximum; chromium, 4.50 to 6.50; tungsten, 0.75-1.00; sulphur, 0.05 maximum, and phosphorus, 0.05 maximum. With proper heat-treatment the following physical properties are obtained: tensile strength, 125,000 lb. per sq.in.; yield point, 100,000 lb. per sq.in.; elongation in 2 in., 18 per cent; reduction in area, 45 per cent, Brinell hardness, 240-260.

Hercules High-Speed Pneumatic Chipping and Riveting Hammers

No valves or flapper plates are used in the pneumatic high-speed chipping and light riveting hammer announced by The Buckeye Portable Tool Co., Dayton, Ohio. The feature of this



hammer is its one diameter piston, which is the only moving part and which is self-controlled. The piston is balanced, and recoil or annoying vibration has been eliminated. The three major parts are the handle, cylinder and piston. Eight models are available for chipping, caulking, beading, scaling, core breaking, drifting, and light riveting operations.

"Helex" Taper Pin Reamer

The National Twist Drill & Tool Co., Detroit, Mich., has announced "Helex" taper pin reamers for machine reaming of taper-pin holes. The steep spiral angle promotes smooth cutting and eliminates chatter. Sturdy backing of the cutting edges prevents chipping. For these reasons the reamer can be run at or near drilling speeds.

The cutting edges are undercut and have a left-hand spiral. The result is a shear cut action. Chip spaces are of ample size to prevent clogging. They are furnished in carbon or high-speed steel in all of the regular sizes in Nos. 6/0 to 14.

"CP" Automatic Chromium Plating Machine for Screws and Bolts

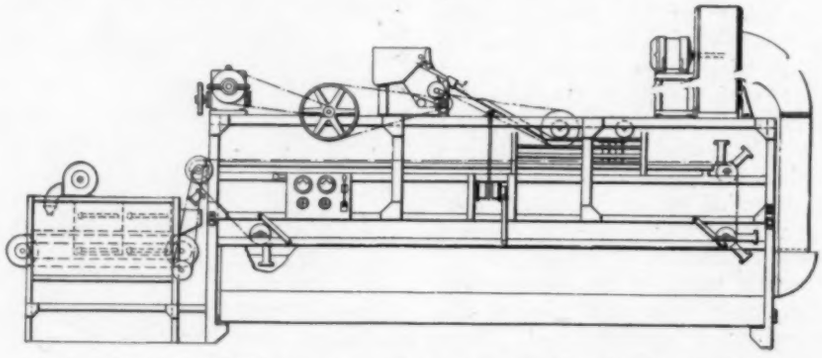
A fully automatic plating machine capable of delivering 90,000 to 120,000 chromium-plated screws or bolts per day has been developed by the Sturt Engineering Corp., 7001 North Clark St., Chicago, Ill. The essential parts of the machine are the feed hopper, feeding mechanism, conveyor and screw holders. Adjustment of the feed hopper and feeding mechanism permits of a great variety of sizes being plated, a No. 6 screw being handled as easily as a 2 or 2¼-in. screw of ¼ or $\frac{5}{16}$ in. diameter. The screw holders are of phosphor bronze, and except for the gripping edge are rubber coated. Provision is made to lift all parts coming in contact with the chromic acid out of it whenever the machine is not in operation.

The screws are fed out of the hopper by means of a gravity chute into an open-end, double slot. The screw holders grab the screws, 15 to 30 at a time, and carry them on a rigidly constructed conveyor directly into the plating tank. At the point where the screws touch the solution, proper electric contact is made, and the screws are exposed to the desired current density during the entire trip through the plating solution. After coming out of the plating tank, the screws are mechanically released from the screw holders and dumped automatically on a washer-conveyor, arranged for hot and cold rinsing. An air dryer finishes the drying operation. The machine is powered by a 2-hp. motor for driving the feed hopper, feeding mechanism, conveyor and washer. A 1½-hp. motor is used for the exhaust blower and a ¼-hp. motor for the dryer. A generator of 1,000 amp. capacity is required.

Jones & Laughlin Special High-Sulphur Bessemer Screw Steel

Developed for increased production in high-speed automatic machine work, a special high-sulphur bessemer screw steel has been developed by Jones & Laughlin Steel Corp., Pittsburgh, Pa. This steel is recommended for automatic machine work only, and should not be used for parts for which higher physical properties are required than are ordinarily found in SAE 1112 or regular bessemer screw steel. The increase in machine production over standard bessemer screw steel was found to range from 16 to 32 per cent with equal tool life.

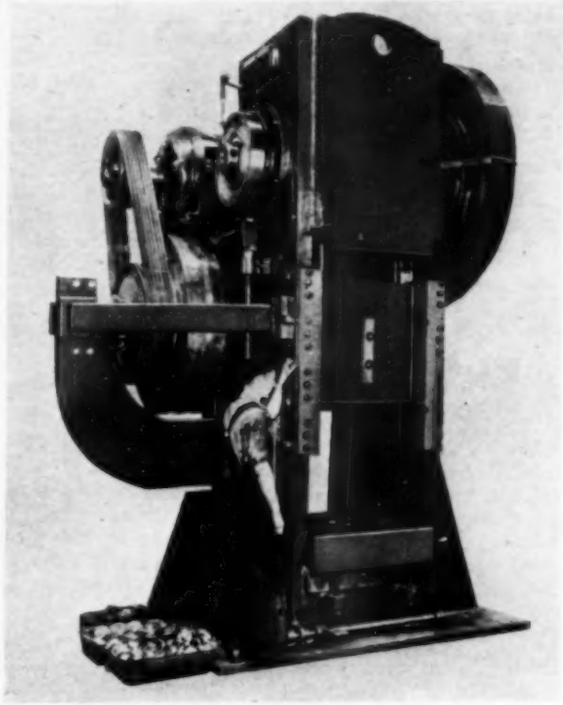
The chemical constituents of the high-sulphur screw steel differ from those of standard screw steel only in that the sulphur content is appreciably higher. This increase in sulphur does not affect the physical properties. The Izod value, the measure of resistance to shock or brittleness, is very low for either standard screw steel or the high-sulphur, and this is the principal factor in limiting the use of these steels. The difference in this value between the standard and high-sulphur screw steels is negligible, and need not be taken into consideration in replacing the standard grade with the high-sulphur.



From 90,000 to 120,000 screws per day are chromium-plated, rinsed and dried automatically on this machine

Verson No. 12B "AllSteel" Forging Press

The No. 12B Verson "AllSteel" forging press, with capacities up to 5,000 tons, is being manufactured by the AllSteel Press Co., 12015 Peoria St., Chicago, Ill. These presses are intended for hot pressing, bottoming, sizing, or coining and pressure finishing in one operation. Arc-welded steel plate construction is used throughout, permitting a sizeable reduction in bulk and weight and not requiring a pit except in the largest sizes. Transportation costs, foundation charges, and power consumption are also lowered by this method of construction, according to the manufacturer. These presses are very similar to the single-crank, straight-sided presses made by the company, except that much heavier plate is used.



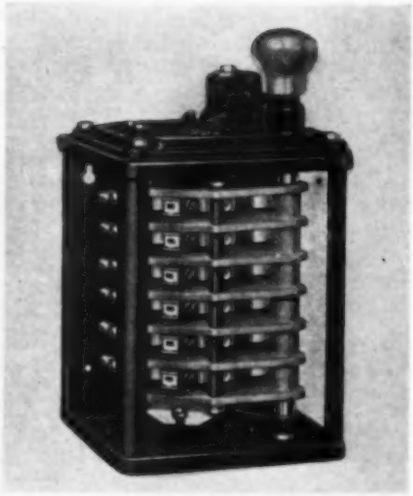
Crankshafts are made from nickel-chrome - molybdenum forgings, heat-treated turned and ground. The wrist pin is of Hy-Ten alloy steel. The ram and knuckle are of steel plate construction, and the ram incorporates a saddle and sliding wedge to relieve the wrist pin of the blow and distribute it. A hardened tool steel insert is placed in the ram face to resist wear. Main, eccentric, and pin bearings are bronze bushed and the steel gibs are bronze faced. Roller bearings are used elsewhere, including the multiple-disk friction clutch. Knockouts are provided in the ram and bed and a wedge adjustment of the bed and saddle are incorporated. The clutch has both hand and foot air-trip operation, an automatic stop is provided at the top of the stroke, and a self-releasing type brake is used. While any desired type of drive may be applied, V-belt drives are standard. All gears are of arc-welded steel construction, the rings being rolled from flat stock. Force-feed lubrication is provided.

The plate from which the frame is built has an ultimate strength of 63,000 lb. per sq.in. and an elastic limit of 35,000. Its ultimate compressive strength is 55,000. The factor of safety used is 6 for varying loads and 10 for shock loads. Connecting screws are turned from Hy-Ten, and have buttress threads.

The 800-ton capacity press illustrated has a bed area of 36x36 in., occupies a floor space of 90x120 in., and weighs 75,000 lb.

Allen-Bradley Drum Reverse Switches

A line of drum reverse switches, designated as Bulletin 350, have been announced by the Allen-Bradley Co., 1311 South First St., Milwaukee, Wis., for across-the-line reversing of a.c. and d.c. motors and for reversing service in connection with magnetic starters. For the direct handling of motor currents, these switches have a maximum a.c. rating of 5 hp., 110 volts; 10 hp., 220 volts, and 15 hp., 440-550 volts. They will handle d.c. motors up to 3 hp., 115 volts, and 5 hp., 230 volts. For reversing service in connection with automatic starters, these d.c. ratings are increased.



Allen-Bradley Drum Reverse Switch for across-the-line reversing of a.c. and d.c. motors

These switches are made in two sizes. The entire drum, including all contacts, drum segments, and terminals, are supported by the top bearing plate, and by this construction permits the inclosing cabinet to be omitted where the switch is to be built into a motorized machine.

Either size of switch can be furnished with a hand lever, with or without spring return, or with rope lever, and in the smaller size a lever for shipper-rod operation can be provided. The switch can be wired for use with limit switches.

PATENTS

OCTOBER 6, 1931

Metal-Working Machinery

Centrifugal Washer and Drier. Leon J. Barrett, Worcester, Mass. Patent 1,825,651.

Milling Machine. Alfred Trosch, Rochester, N. Y., assigned to Consolidated Machine Tool Corporation of America. Patent 1,825,684.

Machine Tool. Alfred Trosch, Rochester, N. Y., assigned to Consolidated Machine Tool Corporation of America. Patent 1,825,685.

Screw Press. Malcolm Walker, Glasgow, Scotland, assigned to James Livingstone, Ardbeg, Scotland. Patent 1,825,686.

Milling Machine. Worthy J. F. Forward and Roland Russell Roberts, Rochester, N. Y., assigned to Consolidated Machine Tool Corporation of America. Patent 1,825,721.

Hydraulically Driven Lathe for Car Wheel Axles and the Like. Worthy J. F. Forward and Sherman A. Harding, Rochester, N. Y., assigned to Consolidated Machine Tool Corporation of America. Patent 1,825,722.

Gear Cutter and Method of Employing Same. Magnus H. Johanson, Rochester, N. Y., assigned to Gleason Works. Patent 1,825,733.

Screw Machine. Judson H. Mansfield and Chester F. Penrose, Rockford, Ill., assigned to Greenlee Bros. & Co. Patent 1,825,749.

Truing Mechanism. Lester F. Nenninger, Cincinnati, Ohio, assigned to Cincinnati Grinders Incorporated. Patent 1,825,753.

Grinding Machine. Cecil W. Hopkins, Cincinnati, Ohio, assigned to Cincinnati Grinders Incorporated. Patent 1,825,797.

Drill Unit With Common Feed. Charles H. Muhl, Richmond, Ind., assigned to The National Automatic Tool Co. Patent 1,825,971.

Grinding Machine. Waldo J. Guild, Worcester, Mass., assigned to The Heald Machine Co. Patent 1,826,070.

Punch Press. Theodore F. Philippi, St. Louis, Mo. Patent 1,826,152.

Sanding Machine. Frederick H. Johnson, Detroit, Mich. Patent 1,826,177.

Grinding Machine. Herbert E. Kempton and Keith G. Gallimore, Fond du Lac, Wis., assigned to The Heald Machine Co. Patent 1,826,178.

Safety Device for Grinding Machines. Harold E. Balsiger, Waynesboro, Pa., assigned to Landis Tool Co. Patent 1,826,445.

Wireworking Mechanism. John F. Gail, Evanston, Ill., assigned to Simmons Co. Patent 1,826,612.

Machine Tool. Charles E. Masters, Perry, Mo. Patent 1,826,625.

Tools and Attachments

Apparatus for Coiling Strips, Etc. Emil Dukes, Pittsburgh, Pa., assigned to Gears & Forgings, Inc. Patent 1,825,657.

Workholding Apparatus. Dwight C. Page, Worcester, Mass., assigned to The Heald Machine Co. Patent 1,825,677.

Reversible and Irreversible Thermo Plastic Bonded Abrasive Articles. Raymond C. Benner, Niagara Falls, and Garnett H. Porter, La Salle, N. Y., assigned to The Carborundum Co. Patent 1,825,771.

Welding Rod. Winston F. Stoody and Shelley M. Stoody, Whittier, Calif., assigned to Stoody Co. Patent 1,825,829.

Stud Setter. Charles R. Leiter, Rochester, N. Y., assigned to Consolidated Machine Tool Corporation. Patent 1,825,876.

Grinding Head Or Attachment. Frank R. Moore, Upper Darby, Pa. Patent 1,825,883.

Differential Adjustment for Rolls. Jane Johnson, Pittsburgh, Pa., assigned to United Engineering & Foundry Co. Patent 1,825,957.

Radius Gage. Eugene J. Witchger, Saginaw, Mich., assigned to Lufkin Rule Co. Patent 1,825,987.

Apparatus for Shearing Aluminum Sections. William Frank Naylor, Bergenfield, and Emery Lawrence Sponseller, Grantwood, N. J., assigned to Aluminum Screw Machine Products Co. Patent 1,826,016.

Grinding Wheel Trimming Fixture. John W. Parker, Detroit, Mich. Patent 1,826,219.

Flanging Tool. James M. Wilkins, Decatur, Ill., assigned to Mueller Co. Patent 1,826,268.

Combined Drill, Reamer, and Tap. Frank H. Mueller, Decatur, Ill., assigned to Mueller Co. Patent 1,826,323.

Power Stop Mechanism. Philip C. Rummel, Jr., Glenside, Pa. Patent 1,826,482.

Furnaces

Furnace. David L. Summey, Waterbury, Conn., assigned to Scovill Manufacturing Co. Patent 1,825,831.

TRADE PUBLICATIONS

A.S.T.M. Standards Book Supplement. The American Society for Testing Materials, 1315 Spruce St., Philadelphia, Pa., has issued the 1931 Supplement Book of A.S.T.M. Standards. It contains 32 standards adopted or revised, of which 17 are new. It contains 144 pages.

Car Wheels. The Carnegie Steel Co., Pittsburgh, Pa., subsidiary of the United States Steel Corp., has issued a booklet entitled "Carnegie Rim Toughened Wrought Steel Wheels" which have the rims toughened and hardened to resist wear and to give higher ductility to avoid brittleness. These wheels are offered for railway service, electric railway service and for crane track wheels.

Diamond Boring Machine. The Ex-Cell-O Aircraft & Tool Corp., 1200 Oakman Blvd., Detroit, Mich., has issued a bulletin on the precision boring machine, Style No. 112, recently described in these pages. Several views of the machine are given as well as types of work which can be done. A complete technical description is also included.

Furnaces. The General Electric Co., Schenectady, N. Y., has issued Bulletin GEA-1324A, superseding 1324, on air-draw furnaces for the quantity drawing of steel parts at temperatures up to 1,200 deg. F., and Bulletin GEA-1495 on bell-type furnaces for bright-annealing coiled steel strip.

Heat-treatment of Steel. The Roessler & Hasslacher Chemical Co., Inc., Empire State Bldg., 350 Fifth Ave., New York, N. Y., has issued a booklet entitled "Heat-Treatment of Steel with Cyanides and Salts," taking up the casehardening, nitriding, reheating and mottling of steels with sodium cyanide, and also coloring, tempering, drawing and annealing of steels with heat-treating salts. This is the sixth edition.

Magnesium Alloys. The Dow Chemical Co., Midland, Mich., has issued a catalog on "Dowmetal Magnesium Alloys," giving the properties, shop practice, available forms and miscellaneous data. Much information is given relative to the weights of different standard shapes and sizes of wrought magnesium alloys.

Melting Pots. The Harold E. Trent Co., 618-640 No. 54th St., Philadelphia, Pa., has issued Bulletin TC-11 on electric melting pots, and other electrically heated industrial equipment, such as soldering troughs, soldering irons, calibration tanks and electrically heated kettles. Complete specifications are included.

Motors. The General Electric Co., Schenectady, N. Y., has issued Bulletin GEA-1475 on Type SCR single-phase vertical motors, and Bulletin GEA-560B, superseding 560A, on Type SCR constant-speed, single-phase motors.

Pipe Tools. The Borden Co., Warren, Ohio, has issued its No. 32 Condensed Catalog, entitled "The Beaver Line of Pipe Tools," giving in very concise form information on its various pipe threading tools and bolt threading tools and accessories. List prices are included.

Plating of Zinc. The New Jersey Zinc Co., 160 Front St., New York, N. Y., has issued a bulletin entitled "The Plating of Rolled Zinc and Zinc Die Castings," which is a compilation of the information necessary for the practical plating of rolled zinc and die-castings. Certain modifications of well-known practices to afford better production are given. Cleaning has also been given particular attention.

Pyrometer, Potentiometer-Type. The Leeds & Northrup Co., 4901 Stenton Ave., Philadelphia, Pa., has available Catalog No. 87 describing the "Micromax" potentiometer pyrometer announced in these pages. Complete details of the instrument are given.

Trichlorethylene. The Roessler & Hasslacher Chemical Co., Inc., Empire State Bldg., 350 Fifth Ave., New York, N. Y., has issued a booklet entitled "Trichlorethylene—Its Properties and Uses." The material is a chemical having many uses, one of which is degreasing metals.

Welded Products. The Bethlehem Steel Co., Bethlehem, Pa., has issued a folder entitled "Bethlehem Welded Construction," showing several jobs of welded construction and giving the advantages.

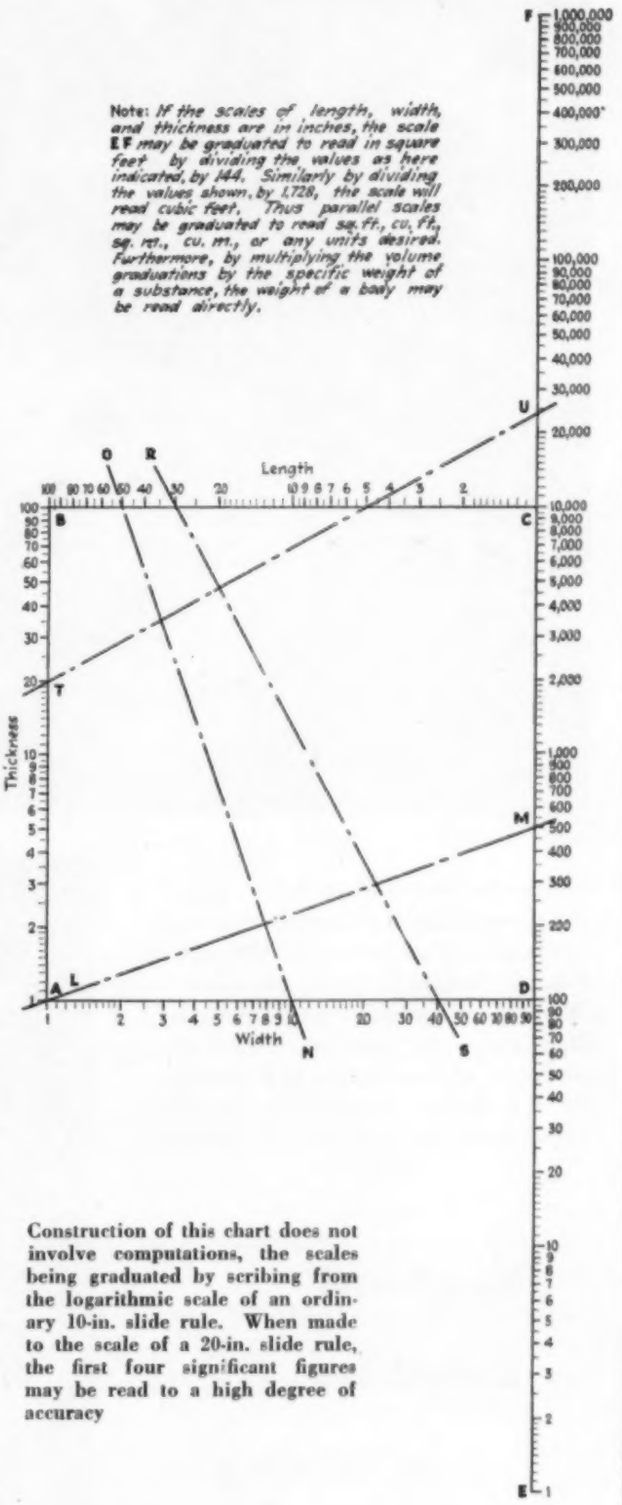
GRAPHIC DETERMINATION OF AREAS, VOLUMES AND WEIGHTS

THIS simple chart for rapid determination of areas, volumes and weights can be constructed easily without making any calculations. A square *ABCD* is first drawn, having a length of 10 in. on a side, the same length as the common slide rule. The right-hand scale extends an additional 10 in. above and below the square.

Graduations are located from the slider of the slide rule. Thus the scale *CB* is obtained by placing the "*C*" logarithmic scale of the slider so that the digit 1 coincides with the point *C* and the digit on the slider representing 100 coincides with point *B*. It is then a simple matter to scribe off the graduations. The scales *AB* and *AD* are similarly constructed. The scale *EF*, 30 in. long, is obtained by laying off the logarithmic scale from *E* to *D*, again from *D* to *C*, and finally from *C* to *F*. Point *D* will then represent 100, point *C* 10,000, and point *F* 1,000,000.

Two perpendicular lines scribed on a piece of celluloid or other transparent material offer the most convenient method of using the chart. In reading, if the area is desired, one perpendicular is passed through the points representing the dimensions of length and width, while the other perpendicular passes through unity on the "thickness" scale. Other readings are made as indicated. The intersection on the right-hand vertical scale will be the answer. The dot-and-dash lines indicate the setting for obtaining the area of a 10x50 surface and also the setting for obtaining the volume of a rectangular parallelepiped or box 20x30x40. Units may of course be varied as desired, providing the same unit is used on all scales simultaneously, with the following exception: Conversion scales from cu.in. to cu.ft. or sq.in. to sq.ft., may be tabulated as indicated in the figure. It will then be possible to read sq.ft. in area or cu.ft. in volume when the dimensions are given in inches or other units.

Although the chart illustrated is limited to linear dimensions up to 100 in., there is actually no limit to the possible dimensions, for merely by spacing off decimal points the chart can be used for quantities as great as desired. The procedure followed is similar to that used in reading a slide rule. This chart, while accurately determined, is not sufficiently large for exact determinations, and some error may also be generated in printing or shrinking of the paper. A chart 10x30 in., easily constructed, will provide sufficient accuracy for the shipping department, general manufacturing, and similar service, while if greater accuracy is desired, the chart may be enlarged to suit. If the size is made 20x60 in. for example, three significant figures and a close approximation of the fourth can be read with ease.


Note: If the scales of length, width, and thickness are in inches, the scale E F may be graduated to read in square feet by dividing the values as here indicated, by 144. Similarly by dividing the values shown, by 1,728, the scale will read cubic feet. Thus parallel scales may be graduated to read sq.ft., cu. ft., sq. rt., cu. rt., or any units desired. Furthermore, by multiplying the volume graduations by the specific weight of a substance, the weight of a body may be read directly.
F
E
O
R
Length
B
C
T
U
M
A
L
D
N
S
Thickness
Width

Construction of this chart does not involve computations, the scales being graduated by scribing from the logarithmic scale of an ordinary 10-in. slide rule. When made to the scale of a 20-in. slide rule, the first four significant figures may be read to a high degree of accuracy

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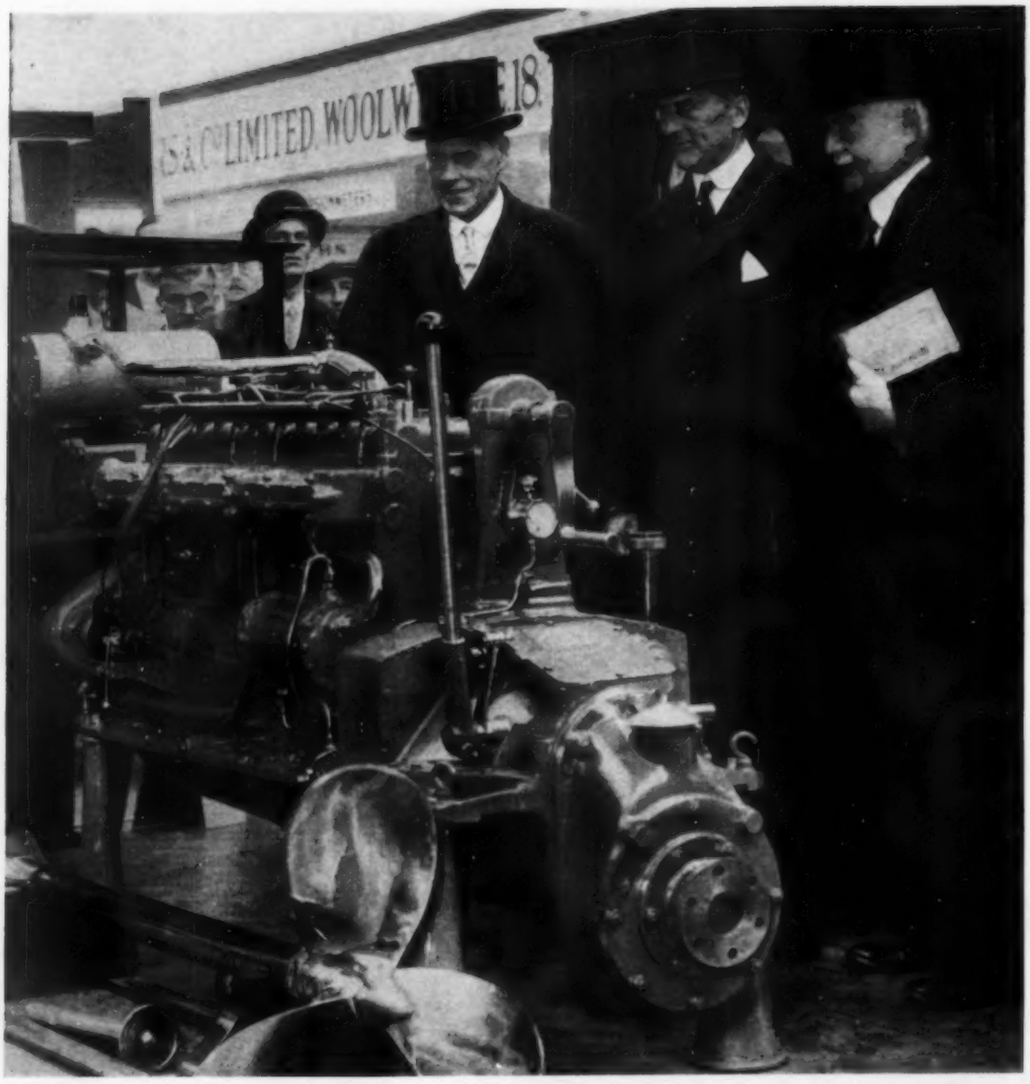

Acme

Sir Austin Chamberlain, K.G., opened the recent Shipping, Engineering and Machinery Exhibition at Olympia, London, England. At his left is Lord Wemyss, at his right Dr. Heleshaw. Beneath is the "smallest" Diesel engine, one of the exhibits at the show. It is a 196 c.c. standard motorcycle type engine converted to compression ignition

England Exhibits at Olympia

AMERICAN MACHINIST

Editors: KENNETH H. CONDIT AND FRED H. COLVIN

New York, October 15, 1931

VOL. 75 NO. 16

Honoring the Arts of Peace

Industrial achievements rarely have memorials erected in their honor. Deeds of war and destruction are acclaimed on every hand, but constructive efforts that have made our present civilization possible receive scant attention. For this reason the recent dedication of the memorials to Hartford industrialists, at the State Trade School in that city, are especially noteworthy. The memorials include a statue in front of the school, one of the few dedicated to workers in metals, another notable example having been erected in San Francisco many years ago.

Inside the building are plaques to Charles E. Billings, a pioneer in drop forging; George J. Capewell, of horse nail fame; Samuel Colt, whose armory was a marvel in its day and gave many well known men their start; Asa S. Cook, whose machines made the wood screw industry possible; Francis A. Pratt and Amos Whitney, founders of the firm that still bears their names; Elisha K. Root, credited with pioneering interchangeable manufacturing in Colt's armory; and Christopher M. Spencer, who was associated with Charles Billings and later developed automatic screw machinery along lines that are still standard for many classes of work.

It seldom happens that such a number of pioneers in any one line of industry hail from a single locality. Or it might be more accurate to say that few localities offered the opportunities for development and growth, for these men were not all natives of Hartford. It is also of interest to note the longevity of these pioneers. Six of the eight attained 75 to 91 years, only two of these having been under 85. Could there be better evidence of the advantage of an active life?

These memorials should be an inspiration to the students of the Trade School, and it is to be hoped that other industrial centers will honor their heroes of peace in equally fitting manner.

Plus or Minus

A New York stock exchange house has published a compilation to show the effect on earnings per share of railroad stock of (1) a five per cent increase in freight rates; (2) a ten per cent cut in wages. The effect of the rate rise would be an increase of from $.72 to $5.43 per share in earnings depending on the railroad; of the wage cut, from $.70 to $6.22.

If we knew how much the rate increase would hurt general business, or how much the wage reduction would diminish consumer buying, we should be in a better position to estimate the real result. To get the complete picture, of course, we should know what the increased earnings per share would be if obsolete rolling stock and motive power were replaced by efficient, modern equipment.

Going At It From the Other End

If the big users of production equipment would replace at least a fraction of their expensive obsolete machinery, business would be provided for the builders of equipment and for the manufacturers from whom they buy materials and parts. Work would be made for employees in all of these plants and consumer buying would thus be revived. So run most of the plans for stimulating business recovery through plant rejuvenation. And they are perfectly sound.

But here is a different approach. Dr. H. N. Davis, president of Stevens Institute of Technology, proposes to go after the small shops all over the country, which are probably guilty of harboring a greater proportion of obsolete equipment. He believes that the Hoover plan for melting frozen banks assets will make loans for equipment purchases available to these small plants, loans that would have been impossible a few weeks ago.

To help the owners of these smaller plants

survey their equipment and to modernize it intelligently he would recruit a force of five hundred unemployed engineers at a nominal salary rate and send them out to work with the shop proprietors.

Dr. Davis' plan may not lead to such large orders as would ensue from modernization of large plants, but at least it proposes a useful occupation for many unemployed engineers some of whom are thinking seriously of placing their ability and experience at the service of Soviet Russia. We need them at home.

◂◂ CHIPS ▸▸

To a nation and a world craving action, President Hoover presents his plan for banking support and economic revival . . . casts aside the ill-becoming rôle of watchful waiter and exercises the same brand of leadership that made him our greatest Secretary of Commerce . . . Response is immediate . . . markets turn and climb . . . bankers rush formation of billion-dollar pool . . . confidence replaces funk . . . High time . . . Annalist index of all commodity prices had fallen to 99.9 per cent of 1913 prices . . . the deflationist had had his day and we were back to pre-war minus.

STILL ANOTHER WEEK

Again, in this issue of *American Machinist*, the contents page carries 330 West 42d Street, New York City, as our address. Again we find ourselves on Tenth Avenue. The decorators and movers state jointly that we shall not be able to move for still another week, the date set being October 24, and subject to change.

Pratt & Whitney announces purchase of Keller Mechanical Engineering Corporation . . . will move plant to Hartford . . . Chicago steel operations up . . . Crocker-Wheeler awarded order for forty special motors designed to eliminate noise . . . Boston import duties rise 13.5 per cent in September . . . Auburn, Oldsmobile, Dodge, Graham-Paige, and Reo increase sales in September . . . Edward G. Budd Mfg. Company purchases in August and September largest since 1928 . . . International Harvester sales of vehicles 1633 in September against 1396 last year . . . Grigsby-Grunow Majestic Radio production stepped up from 3500 daily to 4125 . . . Westinghouse Electric Elevator awarded quarter million contract for fifteen elevators, U. S. Parcel Post Building, New York . . . Missouri Pacific recalls 950 employees to North Little Rock Shops . . . Irving Fisher business conditions index gains 7.3 per cent . . . Glenn L. Martin awarded half million Navy contract . . . sixteen bombing planes.

DIAMOND FACTS

A gentleman whose business has to do with diamond importation surprised us with the information that the biggest buyers of diamonds in the New York wholesale market are motor-car manufacturers. They don't buy them to wear, but for utilitarian purposes. In the old days, Henry Ford was probably the heaviest steady diamond buyer in the country. He purchased an average of half a million dollars' worth annually, to be used in grinding bearings and other automobile parts which require great precision. Latterly he hasn't been buying nearly so much, his engineers having been busy figuring out substitutes for the work. The stones used commercially are, of course, far from being first-class. They bring from $10 to $35 a carat mostly. Oddly, certain manufacturers insist on using certain colors. The diamond dealers don't know why. Cadillac motors, for instance, are turned by gray stones only, as are those of Chevrolets. The Packard Company insists upon brown-tinted stones, but Ford will take either brown or gray.

—THE NEW YORKER.

France appears cool to thoughts of further debt discussion and revision . . . prefers to mark time until Laval can consult with Hoover . . . England, in throes of general election dated for October 28, abounds in confidence . . . It is still too early to foresee final effects of sterling inflation . . . so far, very good . . . Germany shifts from one Bruening cabinet to another Bruening cabinet . . . Canada remains chief export customer for American products . . . thirty million dollars during August.

Almost countless meetings take place this week . . . National Machine Tool Builders Association and Associated Machine Tool Dealers Association, at Chicago . . . American Gas Association, Atlantic City . . . National Safety Council, Chicago . . . Society of Industrial Engineers, Pittsburgh . . . Gray Iron Institute, West Baden . . . American Gear Manufacturers Association, Philadelphia . . . Swope presents still another plan, this one to guarantee employment at General Electric . . . F. J. Griffiths becomes president of Timken Steel and Tube . . . was formerly president, Republic Research . . . Hawkes sets new Chicago-New York record . . . three hours and twenty minutes . . . Sperry

automatic pilot guides eighteen-passenger Curtis Condor plane on two test flights of twenty minutes each . . . does everything but take off and land . . . Giant 48-passenger Sikorsky amphibian rises from Long Island Sound in 45 seconds . . . United States Pipe & Foundry Company and National Cast Iron Pipe Company receive joint order for 30,000 tons worth 700,000 dollars . . . Copper and Brass Research Association re-elects President R. L. Agassiz . . . Roosevelt and Dollar to merge eleven lines with 181 ships . . . Bank clearings (Dun's) rise to 8,530,063 from 7,489,865 last week.

ELEVEN ESSENTIALS

W. J. Donald, managing director of American Management Association, states in the current issue of "Forbes Magazine" that corporations and business men wishing to stay in business during the next decade must meet eleven essential tests: (1) Sound organization of the managing group. (2) Universal adjustment of budgeting. (3) Incentive for executives. (4) Broadening of executives. (5) Unification into Merchandising of production, buying and marketing. (6) Drastic improvement of marketing. (7) Adjustment of production costs. (8) Modernization of the financial organization. (9) Economies in office management. (10) Revision of cost systems and overhead. (11) Elimination of inbred view points and adoption of outside opinions.

THIS WEEK IN *AM*

Now that you have had a chance to read the leading article, "Hydraulic Forming Artificial Limbs," we believe you will agree that it combines technical and human interest to a high degree. That it is an excellent example of successful mechanical pioneering cannot be gainsaid. It goes without saying that we are greatly indebted to George L. Markland, Jr., for initiating the article, to Charles H. Davies for his hearty cooperation in furnishing all the material, and to E. J. Tangerman, assistant editor, for assembling and putting it into final form.

If your plant has not yet had time to react to the Hoover Plan and you are looking for work of permanent value to keep your force busy, clip "New Tool Stands for Old" (page 594) and let the boys get busy along similar lines. The author, C. J. Freund, is apprentice supervisor, The Falk Corporation, and a frequent contributor to *AM*.

Captain Walter Soderholm, author of "From Mining Machinery to Ordnance Gun Mounts" (page 596), needs no introduction. He is at present enjoying a vacation at Virginia Beach, preparatory to sailing for ordnance duty in the Phillipines. P. E. Garlent, author of "Tool Grinding Control" (page 599), is master mechanic, Timken-Detroit Axle Company.

Should development and service costs be segregated in pricing machinery and machine tools? The Executive Forum (page 588) wants to hear where you stand.

• COMING •

Distribution has become the scapegoat of modern industry. But while the public prints are belaboring it and bespattering it with tons and tons of good black ink, and probably not solving the fundamental problem of human inertia at all, let us not forget to keep our eyes on inspection in the shop. Through it can come more losses and more savings than through any other item. That *American Machinist* stresses new inspection methods, new standards, new instruments is no accident. Any experienced operative or executive can cite countless instances of where the savings of modern equipment have been cancelled and transformed into assembly losses, all through faulty or unintelligent or badly equipped inspection.

Though our American loyalties would have us believe that all good things are American-born, our judgment and experience tell us that it is not so. For that reason, we asked our Berlin correspondent to round up the latest and best in German inspection instruments and practice. The first installment of his report constitutes the leading article in the next issue. It will pay you and your associates to read every word carefully, even though certain items may not be wholly applicable to your own class of work.

In the same issue will be found a full description of an economical cutting-off punch and die for heavy wide work, an article giving the highlights on present Plymouth automobile practice, a resumé of heat-treating at R. Hoe & Co., and "Preferred Numbers for Standardization," which shows how to get the jump on involuntary standardization.

Looking beyond the issue of October 22, we might mention an article which demonstrates how one plant manager insured continuing equipment appropriations from his board of directors by means of an exhibit which showed gains and savings made to date. And on November 12, we expect to announce the winners of the *American Machinist* Awards for 1931.

THE . INDUSTRY .

Progress in Metal-Working and Machinery Markets

KELLER'S purchase by Pratt & Whitney provides the spot news of interest in tool markets. . . . Not only are orders lacking, except an occasional tool for replacement, but inquiries. . . . There is little indication of any sudden change, unless prospects can be induced to take advantage of present good prices and deliveries.

NEW YORK had only repercussions on the Navy and Subway lists. . . . Further news on the Subway list filters through, and Navy orders have been sent out; other sales are few. . . . Southern District is holding about even, buying being limited almost entirely to small tools; outlook, including prospects of tool sales to oil producers, continues uncertain. . . . Cincinnati has one manufacturer reporting improvement; others don't see it that way. . . . Selling agents make occasional sales. and some inquiries are coming in. . . . Southwest shows evidence of activity in small specialty shops, but few orders result, since most metal plants are still quiet. . . . Detroit, similarly has small shops busy in addition to automobile and accessory plants; until car sales improve this means little business in machine tools.

CANADA reports upturn in manufacturing, insufficiently widespread to create any demand for tools. . . . New England activity is also increasing, but tool sales are not improving as expected. . . . September, was better than August at that. . . . Indianapolis has some replacement business and an encouraging volume of inquiries from coal operators, radio plants and garages. . . . Used equipment goes hard, only after much haggling over prices. . . . Chicago concurs, and seems disappointed in October.

NEW YORK

Repercussions on the Navy and Subway lists and the Keller purchase by Pratt & Whitney provided the real machine tool news last week. A number of dealers will benefit indirectly from the Subway list, having submitted bids on single items through the two general suppliers. Orders have been received on the Navy list, and readvertising of the remaining lathes will be out shortly. Little other government business is expected soon. Since industrial inquiry seems almost totally lacking, there is little prospect of anything startling in that field.

CINCINNATI

One machine tool manufacturer expressed the opinion that prospects are brightening in some sections. Others do not see it that way. There has been no change in the business level. Almost all orders booked were for single items. Local selling agents are securing an order here and there. A limited number of inquiries are coming in.

SOUTHERN DISTRICT

Activity of the machinery and machine tool market, while not inclined to show lessened intensity, certainly has not shown definite improvement. Sales continue slow with the outlook uncertain. Buying is limited almost wholly to small tools. The petroleum industry continues a source of annoyance. It had been regarded that improvement in this line might react favorably to tool jobbers. No change in the present status of oil, however, is anticipated. General lines, including shipbuilding and industrial activity, have been quiet.

CANADA

There is an evident upturn in manufacturing, but it is not sufficiently widespread to create a general demand for tools. The comparative quietness in industrial circles during the last two or three months has had its effect on the heavy machinery trade; foundries are running on short time, rail mills are practically at a standstill and general metal trades are quiet. There is a decided speeding up of construction, bridge building and road building. The automotive industry is busier, with increased production reported for the month of September. Steel production last month was at its highest level in three months. Another favorable factor is that output of electricity by central electric stations is on the increase. Inventories are at a minimum.

SOUTHWEST

We are now well into the last quarter of the year with no particular change to be noted in the general metal manufacturing situation. Consequently, there is little to be reported in respect to the machine tool and shop supply business. The majority of plants continuing operations on reduced lines do not of course provide any marked outlet for tools. Small specialty shops are active.

NEW ENGLAND

September as a whole was perhaps a bit more favorable than August. October thus far has also produced scattered signs of improvement. While a number of important tool centers have booked good orders from automotive sources, that industry has developed far short of the business generally anticipated, so far short, in fact, that little hope is now expressed for the substantial upward trend. Executives believe October will not measure up to its reputation.

DETROIT

With the exception of an occasional machine replacement and scattered orders for tools and small equipment, the machinery and machine tool trade in the Detroit area is at a standstill. There is no indication of an early improvement. An unusual burst of activity is being carried forward in almost all of the automobile and accessory plants as well as in the tool, jig and die shops that take in contract jobbing work for the motor car industry. More tool and die work is being done at this time than at any time in 18 or 20 months.

INDIANAPOLIS

While very few machine tools are being sold for new projects, there is some replacement business. An encouraging volume of inquiries is being received from coal operators, ranging from small tools for use in their own machine shops to heavy machinery. Railroad demand continues disappointing. Continued demand for a wide line of equipment comes from the radio industry and the allied trades. Indiana cabinet factories are particularly busy. A fair volume is being purchased by garages, mostly consisting of small lathes, chain hoists and the like. Used equipment is being sold in small volume, with much haggling over prices.

CHICAGO

The first week of October, looked forward to hopefully as the possible forerunner of a period starting an improved market, has failed to indicate any upward trend. Sporadic inquiries are reported, mostly for replacement tools. Optimism is still missing. Intense effort continues to close prospective sales. Occasionally such efforts meet with a modicum of success, but in the main, procrastination until such time as buying is justified by a rift in the industrial depression, is given as a reason for refusal to close. Automobile machine and repair shops are chief among the sources from which present business is derived. Dealers in used tools report few inquiries and fewer sales. There are no lists in sight, nor, so far as can be ascertained, are there any in prospect.

WEEK . BY . WEEK

BUSINESS BAROMETER

Trends in General Business throughout the world

THEODORE H. PRICE
Editor, Commerce and Finance, New York

"Hazeractine" is a word that the Southern Negroes have coined to describe a period of mental distress or doubt. No official definition for it is to be found, but its significance will be easily understood by those who know the Southern darkey. If he understood the business done on the stock exchanges or the commodity exchanges of this country and Europe, he would probably wonder how the men that were subjected to such strains were able to stand them, and there are many white men who feel the same way about fluctuations on the world's exchanges.

Last week these fluctuations were more radical and inexplicable than usual. Many explanations for the ups and downs recorded have been printed in the daily newspapers and otherwise. It is, however, to be doubted whether any of them include all the facts which have been at work in changing the mood of the public from depression to elation and back again. The consoling thought is that no real property has been destroyed by the fluctuations registered, and that a return of normalcy cannot be much longer delayed unless the whole world becomes irrational and homicidal or suicidal. There was indeed a brief few minutes when such an amazing possibility suggested itself to the looker-on, but the excitement is subsiding, and the indications are that we will soon be on an even keel again.

Most Important

News that the National Credit Corporation will be immediately organized in line with President Hoover's suggestion is probably the most important domestic economic announcement that has been published for years. The $1,000,000,000 which is expected to be made available to the corporation by the country's banks will be used to discount sound bank assets not now eligible for rediscount by the Federal Reserve Bank.

Opinion differs as to whether it means inflation or not but everyone is agreed that it assures credit to those who are entitled to it but cannot now obtain it and for this reason it has had a re-assuring effect. Credit itself is intangible; so is capital to some extent. But they are both essential to the conduct of business and the body commercial was rapidly drifting into a situation where the life-blood of business failed to re-create the energy and confidence upon which men usually rely in their dealings with one another.

These observations are prompted by the week's developments in the commercial and financial markets where the trained minds of merchants, manufacturers, and industrialists are busy trying to find some way out of the impasse which has been created by Great Britain's suspension of gold payments and the Oriental hope that the silver standard can be re-established on a practicable basis. There are many other subordinate questions that ought to be considered at the same time, but the preeminent issue is gold versus silver as a standard of value. In Europe and the United States the dominating opinion favors gold, although it has been temporarily relinquished. In Latin America and the Orient silver is preferred from centuries of use.

Conflict of Opinion

The conflict of opinion is not a new one. It has often come to the front during the centuries in which the monetary value of silver was recognized. Just now, however, we have a situation that is without precedent in its importance. More than one half the world's population wants silver and it is said to have a great deal of it. The other half, including the United States and France, as well as Great Britain, wants gold, and has hitherto been insisting upon it. That a controversy so important can be solved by cable or a single conference is not to be expected. The issues at stake are fundamental, and worthwhile predictions of the future are impossible until some plan for dealing with the monetary phase of the nations' problems is in sight or discernible.

General business is improving gradually, and seems to be sound, but the prosperity to which we believe, ourselves entitled will not make itself felt until commerce can be provided with a stable medium of exchange that will be acceptable in every market of the world. Briefly we may say that last week's records show that the stock market went up and down and then up again, and that the commodity markets followed the Stock Exchange.

The holders of railway securities have been made cheerful by the hope that the Interstate Commerce Commission will shortly authorize the consolidation of most of the Eastern railways outside of New England. The scheme contemplates the creation of four great railway corporations which will operate the consolidated mileage. Some time must elapse before it can be made effective, but the plan seems nearer realization than any of its predecessors have been. Washington advices indicate that an early decision is expected from the Interstate Commerce Commission on the application of the railroads for an increase in freight rates.

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THE BUSINESS WEEK

October 14, 1931

After circling the globe the typhoon of deflation which started here three years ago came back home last week. . . . The Administration's last-minute emergency effort to meet its world-wide destructive fury by substituting private local relief for Federal Reserve and congressional action should afford a breathing-spell unless the lull in the storm is interrupted by renewed outbreaks abroad. . . . Everything now depends upon how far these efforts will restore public confidence, permit prompt pressure to be brought toward domestic re-inflation, and be supplemented as soon as possible by concerted international action. . . . The securities and commodity markets are evidently still uncertain as to how thoroughly the deflation doctrine has been repudiated here and abroad, and how aggressively a reversal of the process wil be carried out. . . . Faced, further, with the prospect of continued unemployment, slack business, coming congressional chaos, and prolonged political and financial instability abroad, they will probably be subject to extreme fluctuations for a considerable period. . . . In the meantime domestic business indicators show no definite turn for the better, but despite the absence of any sign of seasonal stimulation they still hold slightly above the bottom established by basic consumption requirements. . . . Considering the depths to which the deflation process has been pushed, it is plausible to expect that the developments of the next few months will mark the turning point of the depression if domestic and international leadership is at last mobilized for aggressive action.

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Material Trends and Prices . . . .

A very slight improvement in inquiry has developed in the last week, in copper, track materials, line pipe, automotive sheets, bars and strips. A sagging market with shaded prices still obtains in bolts, nuts and rivets, at principal centers. Non-ferrous metals such as lead, tin and zinc, continue in dull and uncertain markets.

(All prices as of Oct. 9, 1931)

IRON AND STEEL

Pig Iron—	Current	Mo. Ago	Yr. Ago
Birmingham, No. 2, Fdry., per gross ton	$12.00	$12.00	$14.00
Buffalo, No. 2, Fdry., per gross ton	17.00	17.00	15.50
Heavy Melting Steel Scrap— Pittsburgh consuming point, No. 1, per gross ton	10.25	10.50	14.50
Furnace Coke—Connellsville, per net ton	2.40	2.40	2.60
Foundry Coke—Connellsville, per net ton	3.25	3.25	3.50
Steel Shapes—Pittsburgh, base, per 100 lb	1.60	1.60	1.60

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Iron Machinery Castings—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight, 275 lb:

Chicago....4.62½ Cleveland....4.50 New York....4.75
Cincinnati....4.40 Detroit....4.00

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Steel Sheets—Prices in cents per lb., del. from warehouse stock (except at Pittsburgh) in lots of 401 to 999 lb., ordered and released for shipment at one time:

	Pitts. Mill	Chicago	Cleveland	New York
Blue annealed, No. 10*	1.85	3.20	3.00	3.40
Black sheets, No. 24	2.40	3.55	3.60	3.50
Galvanized, No. 24	2.90	4.10	4.00	4.00

* Light plates.

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Seamless Steel Tubing—Cold-drawn mechanical tubing, round, .10 to .30 carbon, in lots of less than 100 ft. or 100 lb., net, at N. Y. warehouse:

Thickness of Wall		Outside Dia. in Inches					
		¼	⅜	½	⅝	1	1¼	1½
Inches	B.w.g.	Price per Foot						
.035	20	$0.15	$0.16	$0.17	$0.18	$0.19	$0.21	$0.23

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Shapes, Plates, Bars, Etc.—Warehouse base prices in cents per lb., del. in lots of 401 to 999 lb., ordered and released for shipment at one time:

	New York	Cleveland	Chicago
Bands	3.40	3.00	2.95
Bars, soft steel	3.10	2.75	2.75
Cold fin., flat or square	3.90	3.60	3.60
Cold fin., round or hexagon	3.40	3.10	3.10
Cold rolled strips	4.95	6.00	5.50
Floor plates	4.85	5.00	5.00
Hoops	3.75	3.65	3.50
Rivets	4.00	4.00	4 00
Shapes	3.10	2.95	3.00
Spring steel	4.00	4.00	4.00
Tank plates	3.10	2.95	3.00

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Stainless Steel—Hot-rolled bars, base, Pitrsburgh, 0.12 per cent carbon, cents per lb:

Chromium		Chromium	
15% and under	19.00	18 to 23%	23.00
15 to 18%	20.50	23 to 30%	28.00

Bolts and Nuts—Discount from list, f.o.b. mills, Birmingham Chicago, Cleveland and Pittsburgh, on machine bolts, all sizes, cut thread; nuts, hot-pressed or cold punched; and lag screws, mill lots 73-10%

NON-FERROUS METALS

Prices following are in cents per lb. for mill shipments in carlots:	
Aluminum ingots, 99%, N. Y.	23.30
Copper, electrolytic, Conn	7.00
Copper wire, base, Chicago and Cleveland	9.37½
Copper wire, base, N. Y.	9.25
Lead, pigs, E. St. Louis	3.82½
Tin, Straits, pigs, spot, N. Y.	22.37½
Zinc, slabs, E. St. Louis	3.57½
Prices following are in cents per lb., base, N. Y., Chi. and Cleve:	
Brass rods, high	11.25
Brass sheets, high	13.00
Brass tubing, high	16.25
Copper, drawn round	13.62½
Copper sheets	16.12½
Copper tubing	15.62½
Prices following are in cents per lb., del. from N. Y. warehouse:	
Babbitt, anti-friction, general service	29.00
Babbitt, com'l, intermediate grade	34.75
Babbitt, genuine, highest grade	43 00
Solder, bar	18.00
Prices following are in cents per lb., base, Huntington, W. Va:	
Monel metal rods, hot rolled	35.00
Monel metal sheets, full finished	42.00
Monel metal tubing, seamless	65.00
Nickel rods, hot rolled	45.00
Nickel sheets, full finished	52.00
Nickel tubing, seamless	75.00

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Scrap Non-Ferrous Metals—Dealers' purchasing prices in cents per lb., f.o.b. cars:

	New York	Cleveland	Chicago
Heavy yellow brass	2.50	2.50	2.25
Light brass	2.00	1.75	2.25
No. 1 rod-brass turnings	3.00	2.75	2.25
Heavy copper	5.00	4.00	4.00
Light copper	4.00	3.75	3.75

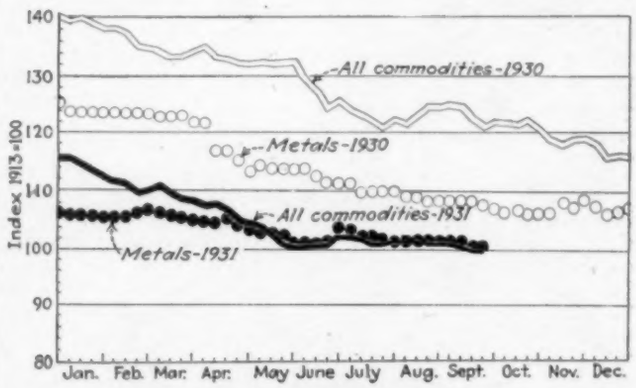
SHOP SUPPLIES

(Prices at warehouse)	New York	Cleveland	Chicago
Abrasive disks, aluminous oxide, No. 50 grain, cloth, 6-in. dia., X weight, per 100	$4.37	$4.59	$4.59
Belting, leather, heavy, discount	30–10%	40%	40%
Belting, rubber, trans., 1st grade, discount	60–10–10%	60–10%	60%

Lumber—Per M ft., b.m., 12-16 ft. lengths, del., N. Y:

Crating—Southern pine:
1x4-in.... $20.00 1x6-in.... $22.00

Skids—Spruce:
2x4-in..$32.00 3x4-in..$33.00 4x6-in..$35.00 6x6-in..$38.00



Price Indexes Week by Week

(6 Metals and 74 Commodities—Figures from The Annalist.)

NEWS

S.A.E. Production Meeting Marks Change in Emphasis

Detroit, Mich., Oct. 9.—The 1931 S.A.E. production program, made up of articles on intensive developments of recent processes, marks a change in emphasis over previous meetings. Despite the fact that 77 per cent of the automobiles of the country are made within an 85-mile radius of Detroit, attendance of automotive production men was not as large as would naturally be expected. A liberal sprinkling of representatives whose main interest is outside automotive work was in evidence. Papers presented (*AM*—page 564, vol. 75) were carefully prepared, and marked by an absence of extravagant claims, but offered more in the nature of progress reports on a firm foundation of real achievement.

The paper on hot coining elicited considerable interest as representing an advance in the forming of metal. The Maxipress developed by the National Machinery Co. forms parts from blanks instead of bars, and in the case of hot forming the heat is lower than required in forging methods. This avoids trouble with scale. Cold coining of metal is on the upgrade and semi-forging of hot steel is here. Bearing rings formed by the coining method can be held to such close tolerances that only grinding is needed to complete the process. It was stated that one ring job was coined from tool steel.

The Thursday program was well planned by the program committee. Permanent molding was presented in a paper by J. L. DOSTAL and a trip through the Holley Carburetor Co. served to demonstrate the process. While this process is applied to gray iron castings and consequently is not a duplication of the coining process, the two together demonstrated a basic growth in two of our oldest industries and again serve to refute the prevalent idea that management's production problems are solved and that chief managerial attention should be diverted to distribution.

It was evident in various little group chats that engineers and production men are increasingly recognizing the social implications of their work and the necessity for increased participation in endeavors to ameliorate conditions unfavorable to worker prosperity. This point was stressed by LOUIS RUTHENBURG at the banquet in pointing out the dramatic timeliness of the Swope plan presented a few days ago. Mr. Ruthenburg sounded a sincere call to production men assembled to work in closer cooperation with sales, to keep their equipment and methods flexible to meet successfully design changes in their industry which threaten to develop faster than ever before.

Present conditions in the auto industry are, according to Ruthenberg, not similar to those in 1921. At that time the industry was in the expansion stage, with car registrations a little over one-third the number of families; now conditions are reversed, registrations being greater than the number of families. Now that it is a mature industry it will follow the slow growth of general business, depending upon the replacement sales and incidental growth. The slogan now is "anything which can be sold can be built," which used to be "anything which can be built can be sold."

In facing the trilogy of meeting schedules, improving quality and reducing costs, the speaker feels that improved tools must be brought into the fight. There will be the necessity for automobile production men to train apprentices, productive workers and foremen, and the latter must be made general business managers of their departments. In the past, production men have neglected the economic and human relations aspect of their jobs for the technical.

Engineers, believes the speaker, are peculiarly fitted to function in the economic and human relations field because of familiarity with fundamental laws. Prosperity is wealth in motion. To discuss prosperity in terms of wealth mass is beside the point. It must be in motion. Ruthenberg states that now is the time to prepare mentally for future prosperity.

Symbolizing Invention, Design and Engineering, this bronze figure is the principal element of the memorials to Hartford industrialists recently dedicated (*AM*—page 546h, Oct. 1) at the Conn. State Trade School

Pratt & Whitney Purchases Keller

President CLAYTON R. BURT announces that the Pratt & Whitney Co., Hartford, Conn., has purchased the entire factory of the Keller Mechanical Engineering Corp., 70 Washington St., Brooklyn, N. Y., as of Oct. 1, and will move the plant to Hartford, including all machinery, equipment, tools, patterns, fixtures, and inventory. The business will be operated in Brooklyn until some time in November, and operations will be resumed at Hartford Dec. 1 in some of the manufacturing buildings formerly occupied by the Pratt & Whitney Aircraft Co.

Keller employs between 200 and 300 men, a number of whom will be transferred; Pratt & Whitney employees will make up the remainder of the personnel. ALEXANDER S. KELLER has been appointed manager of the Keller Division of Pratt & Whitney, and will take up his residence in Hartford shortly. JOSEPH F. KELLER, one of the founders, will also be associated with the company in an advisory capacity.

Keller, founded in May, 1896, now builds a line of automatic die sinking and tool room machinery and other miscellaneous precision tools, adding to the Pratt & Whitney line very desirable elements which will give additional work to many of its departments.

Swope Plan Assures Men Six Months' Work

A virtual guarantee of six months' employment beginning Nov. 1 for all shop workers of the General Electric Co., was given Oct. 6, in a plan submitted to employees by GERARD SWOPE, president. The proposal is to be voted on by the employee members of the General Electric unemployment pension plan, which embraces the great majority of all shop employees.

This plan, as described by Mr. Swope, is "to so divide the work that there will be no further layoffs for lack of work between Nov. 1, 1931, and April 30, 1932, without compensation, and that all those on the payroll on Nov. 1, 1931, will receive during this period not less than the equivalent of one-half of their weekly average earnings for full time, but in no case more than the average of $15 a week." "If actual earnings are above the average, however, the employee is to receive his actual earnings," he said.

The method of insuring this result is to be threefold. Employees are to be assigned to work outside their regular work, if necessary, at the prevailing rates of pay for such work. The unemployment emergency fund, which has been operating since Dec. 1, 1930, is to be augmented by increasing the contributions of 1 per cent of earnings now made by all employees working more than half time to 2 per cent, and by increasing the company's contributions to match those of the men. This increased fund may then be drawn upon by the employees "under the present provisions."

British Tool Show Postponed Two Years

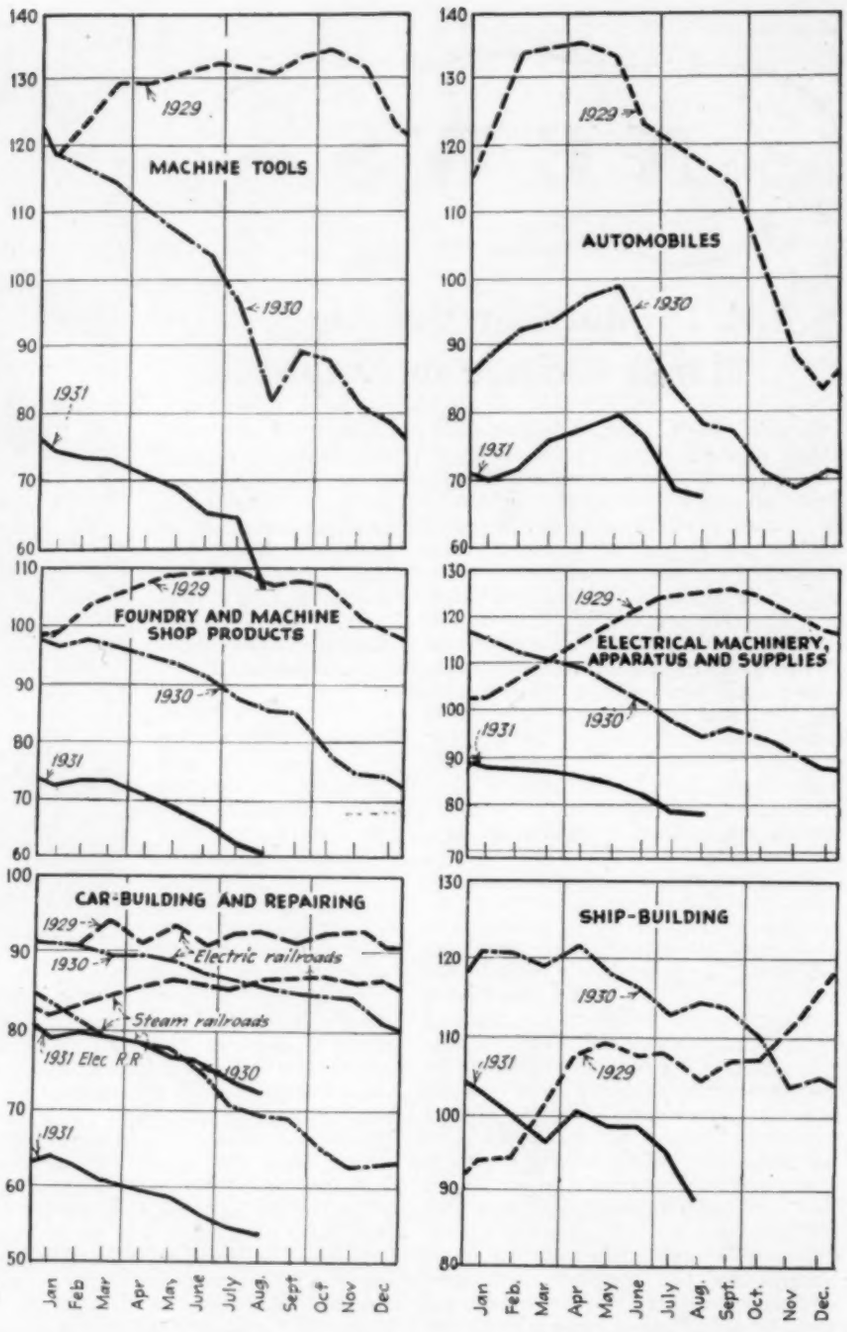
The Machine Tool Exhibition, planned to be held at Olympia, London, W., England, in July of next year, has been postponed until the end of 1934. The decision was made recently at a special meeting of the Machine Tool Trades Association.

Gray Iron Institute Meets This Week

West Baden Springs, Ind., has been chosen for the fourth annual convention of the Gray Iron Institute today and tomorrow. Group sessions will feature the convention, and GEORGE L. WILLMAN, of Chicago, will be in charge of a merchandising clinic devoted to a discussion of the present market and the possible development of new markets for gray iron castings. WILLIAM J. GREDE, president of the Liberty Foundry, Inc., will lead a round-table discussion on "Rate Setting in Gray Iron Foundries"; R. O. FLANDERS, secretary of the Blue Valley Foundry Co., will discuss "The Foundry Balance Sheet and Budget, How They Help," and CHARLES A. KLAUS, Eastern cost consultant for the Institute, will discuss "Savings from Comparative Cost Reports," giving examples from his own experience.

Subjects scheduled for a technical session include "Interpretation of the Technical Bulletin"; "Proposed Specifications," and "Standard Practices and What They Mean to the Industry," the latter by OLIVER SMALLEY, Institute technical director.

Three dinner meetings are planned. The first is a dinner tonight at which advantages of the institute and its activities will be outlined, the second a noon luncheon at which W. J. BARRETT, a member of President Hoover's unemployment commission, will discuss employment in the gray iron industry, and the last, the annual banquet tomorrow night at which DAN M. AVEY, editor of *Foundry*, will discuss the convention.



TREND OF EMPLOYMENT IN METAL-WORKING INDUSTRIES Monthly average for 1926 = 100. Data supplied by the Bureau of Labor Statistics.

Mr. Berndt Sails

E. BERNDT, technical director and vice-president Schiess-Defries A.G., Düsseldorf, Germany, has returned to Germany after a month in the United States observing outstanding engineering achievements and studying the American market for his company's products.

Acetylene Association To Meet in Chicago

The thirty-second annual convention of the International Acetylene Association will be held at the Congress Hotel, Chicago, from Nov. 11-13. Open discussion will be a feature of this year's meeting, some of the subjects being "Welding and Industry in 1932"; "Training Welders and Testing Welds"; "Welding in the Transportation Industries"; "Welded Piping and Pipe Lines"; "Welding in the Chemical Industry," and "Education in Welding." Up-to-the-minute discussions will also be given on "Business Prospects for 1933"; "Welding and Its Future"; "Revised A.S.M.E. Boiler Code"; "Training Welders"; "Testing Welds"; "Aircraft Welding"; "Railroad Welding"; "Marine Welding"; "Automobile Welding"; "Welded Piping Design"; "Pipe Line Welding"; "Welding the New Alloys"; "Painting, Enameling and Lacquering Welded Joints"; "Engineering Education in Welding," and "Industrial Acceptance of Welding." Motion pictures and slides will be used to illustrate many of the discussions.

A.S.M.E. Annual Meeting Program Ready Soon

Twenty-six technical sessions, combined with lectures and social events, are included in the program for the fifty-second annual meeting of the American Society of Mechanical Engineers, to be held at the Engineering Society Bldg., 29 West 39th St., New York City, from Nov. 30 to Dec. 4. Dr. S. Marion Tucker, head of the Department of English, Polytechnic Institute, Brooklyn, N. Y., who delivered lectures last year on "Talking with an Audience," will continue these lectures three mornings during the meeting preceding the technical sessions. Among the other non-technical events are the usual new-members' dinner at the Hotel Astor, the art exhibit, and a public-speaking contest. The conferring of awards, usually made during the business meeting, will be part of the Tuesday evening function this year. Included in the technical sessions will be such subjects as machine-shop practice, materials handling, applied mechanics, power, textiles, fuels, management, fluid meters, hydraulics, steam tables, lubrication, aeronautics, iron and steel, oil and gas power, education and training, and boiler-feedwater studies.

Electrochemical Society Meets in April

According to a recent announcement, the spring meeting of the Electrochemical Society will be held in Baltimore, April 21-23, 1932, at the Lord Baltimore Hotel, with the principal technical session being on "The Electric Furnace and Its Products." Dr. J. T. MacKenzie, chief chemist, American Cast Iron Pipe Co., Birmingham, will preside.

F. A. Lidbury, president of the Oldbury Electro Chemical Co., Niagara Falls, N. Y., will be in charge of a round-table discussion on "Electrochemistry and the Fertilizer Industry."

Exports to Russia Again Show Gain

A substantial increase in the value of exports to Soviet Russia in August over July, 1931, and August last year is shown in an analysis of American foreign trade by the Department of Commerce. Exports to Russia in August are valued at $7,288,551, compared with $5,502,378 in July, and $5,443,198 in August, 1930. Imports from Russia in August were $729,557 against $1,129,204 in July and $2,116,290 in August last year. Department officials point out that August exports to Russia do not reflect an actual increase in the volume or value of current sales, which have fallen recently due to the absence here of favorable long-term credit facilities.

The total foreign trade of the United States in August was valued by the Department at $331,491,662, a reduction of $23,652,261 from the preceding month and $184,691,041 below August, 1930. For the first time in many years there was an unfavorable balance, imports during the month exceeding exports by nearly $2,000,000.

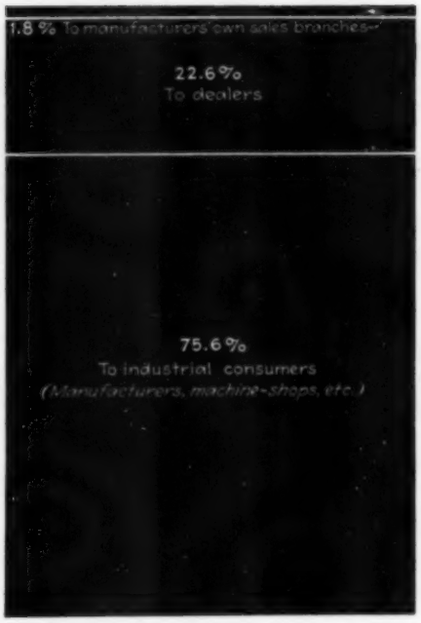
Canada remained the chief foreign consumer of American products during August, with $30,578,832 of imports from the United States.

Federal Specifications

Federal Specifications GG-S-776 for Steel Straightedges has been resubmitted as a proposed revision of Federal Specification No. 599. A federal specification has also been proposed for steel transfer cases.

Distribution of Accessory Sales

Three-fourths of the sales by manufacturing plants engaged primarily in making machine-tool accessories and small metal-working tools are made direct to industrial consumers, such as manufacturers and machine shops. Data collected for the Census of Distribution show that of the total sales by these plants in 1929, amounting to $140,987,000, 75.6 per cent, or $106,441,000, was made in this way. Sales to dealers accounted for 22.6 per cent, or $31,991,000 of the total sales. Manufacturing plants sold 1.8 per cent, or $2,555,000 worth of goods, to their own sales branches. This report does not show the further distribution of sales by these branches.



Distribution of 1929 machine tool accessory and small tool sales

Of the above sales to dealers and industrial consumers $13,565,000 was made through manufacturers' agents, selling agents, brokers, or commission houses. Seventy-nine manufacturing plants sold through such agents, 16 of them selling their entire output in this way.

The total of the sales as shown above is $3,424,000 less than the value of products reported for the industry. This difference is accounted for as follows: contract work and repairs reported by 115 plants amounted to $2,305,000; and differences unexplained by manufacturers, but which possibly represent stock on hand, amounted to $1,119,000.

This report shows the sales channels used by the 722 manufacturing plants whose principal products are punch press equipment such as sub-presses, punches, dies, etc., milling cutters, reamers, chucks, drills, taps, threading tools, etc., as well as specially designed equipment, tools and machinery. A Census of Manufactures report giving preliminary statistics on production, wage earners, wages, etc., for this industry was issued by the Census Bureau in 1930. A final report, in which the statistics will be presented in greater detail, will be issued later.

The 1929 distribution in machine-tool sales was shown on p. 510H of the Sept. 24 number, *American Machinist*. More than half of the sales by machine tool manufacturing plants are made to users, the percentage being 58.4, while 29.7 per cent are sold to dealers and 11.9 per cent to manufacturers' own sales branches.

BUSINESS ITEMS

The Fort Pitt Flask Equipment Co. has been organized following a number of years experimental work in the plant of the Fort Pitt Steel Casting Co., McKeesport, Pa., and a number of other foundries doing a wide variety of work. (*A.M.*—page 192j, July 23.) Offices have been established in the Oliver Bldg,. Pittsburgh, with C. H. CURRY president; H. J. KOCH vice-president, and C. S. KOCH treasurer. In addition to selling flasks manufactured at the Fort Pitt Steel Casting Co. plant, a working arrangement will be entered into with steel foundries to provide flasks of any required type. C. W. MILLER, recently a foundry engineer in consulting work, will be engineer for the new company. J. C. PEIRCE, lately with the Pressed Steel Department of the Truscon Steel Co., specializing in flasks, will be sales engineer. W. R. BECK, also to be identified with sales and engineering work, was at one time chief engineer of the Hill Clutch Co., Cleveland, and later was chief tool designer of the Pressed Steel Co., Detroit. LEO B. CALLAHAN, until recently identified with the West Michigan Steel Foundry Co., will also be a sales engineer.

A $75,000 expansion program has been announced by the Red Jacket Pump Mfg. Co., Davenport, Iowa, coincident with its entry in the electrical power pump field. The company, which has heretofore confined its manufacture to hand and windmill pumps, is the largest manufacturer of these types of pumps in the country. Production of the new electric pump is expected to be underway by the first of the year, and world rights to the Dorward rotary power head have been acquired from the Alamo Engine Co., Hillsdale, Mich., A. E. HAZELTINE, secretary and general manager of the firm, has announced. The company will spend $25,000 in installation of heavy duty and high production machinery and another $50,000 is represented in investment in patterns, dies and jigs.

The Rockford (Ill.) Screw Products Co. has been licensed by the Dardelet Threadlock Corp., 120 Broadway, New York, N. Y., to manufacture and sell bolts, nuts, and screws threaded with the Dardelet self-locking thread. Manufacturing and selling licenses for the Dardelet thread have also recently been granted to Wm. Gaskell & Son, Brooklyn, N. Y., Harrison (N. J.) Bolt & Nut Co., and to the Standard Pressed Steel Co., Jenkintown, Pa.

Consolidated Industries has secured the patent, trade mark, manufacturing and sales rights, as well as the right to all future developments for the British Empire of the home laundry appliances of the Conlon Corp., of Chicago. The new products will be manufactured at the company's plant in Toronto. The new division will be entirely Canadian, owned and operated by Consolidated Industries Products, Ltd.

The Blackman Hill Co., 1513 North Broadway, St. Louis, Mo., has been appointed exclusive representative in Missouri and southern Illinois by the R. Y. Ferner Co., Investment Bldg., Washington, D. C. The E. A. Kinsey Co., Cincinnati, has been appointed exclusive representative in southern Ohio and Kentucky. Both companies will sell Swiss jig borers, precision threading lathes and linear and circular dividing machines by the Societé Genevoise d'Instruments de Physique, of Geneva, Switzerland, for which the Ferner company is U. S. and Canadian agents.

The Western Cartridge Co., Ltd., is seeking a site in Calgary, Alberta, and proposes to erect a plant for the manufacture of shot-gun shells and small arms ammunition of all kinds. The concern is headed by W. J. SIMPSON.

William McPhail & Sons, of Glasgow, founders and manufacturers of non-ferrous castings, have established a branch foundry in Vancouver. The new concern specializes in all kinds of marine engine work, and is equipped to handle all types of copper, nickel, bronze and brass castings.

The United States Pipe & Foundry Co., and the National Cast Iron Pipe Co., have jointly received a 30,000-ton order for cast-iron pipes, delivery to be completed to Lincoln, Neb., in nine months. The cost will be somewhere around $700,000.

The Bunting Brass & Bronze Co., Toledo, Ohio, has opened a new branch sales office and warehouse at 1250 Ontario St., Cleveland, Ohio, to carry a complete line of the company's products.

PERSONALS

GEORGE W. DAVIES, formerly assistant secretary and treasurer of the Campbell, Wyant & Cannon Foundry Co., Muskegon Heights, Mich., has become assistant to the president of the Lakey Foundry & Machine Co., Muskegon, Mich., in charge of general sales.

HARRY L. ERLICHER, who entered the employ of the General Electric Co. as an office boy in the purchasing department, has been appointed purchasing agent, succeeding L. G. BANKER, who retired Oct. 1 after 43 years service.

G. B. KARELITZ

WILLIAM T. BENTZ has been appointed manager of sales of rail steel products of the Republic Steel Corp., Youngstown, Ohio, according to an announcement by N. J. CLARKE, vice-president in charge of sales. Mr. Bentz was formerly sales head of Steel & Tubes, Inc., a Republic subsidiary. His headquarters will remain in Cleveland for the present.

P. C. DAY, of the Falk Corp., Milwaukee, Wis., will speak on "Good Practice in the Manufacture of Speed Reducers" at the Semi-Annual Meeting of the American Gear Manufacturers Association, to be held at the William Penn Hotel, Pittsburgh, today, tomorrow and Saturday. JOHN P. WRIGHT, of the Foote Bros. Gear & Machine Co., will speak on "How Management Can Readily Be Informed from our Cost Records as to the Profit or Loss Sustained on Miscellaneous, Special Non-Schedule Jobbing Orders." Another feature of the program will be an analysis of the bids of two companies who participated in the "bidding" on the request for quotation on some gears sent out to member companies under the direction of the A.G.M.A. Commercial Standards Committee. The companies who have been asked for their analyses are Pittsburgh Gear & Machine Co., and Foote Gear Works, Inc.

J. V. EMMONS, chief metallurgist of the Cleveland Twist Drill Co., discussed "Failures and Remedies of Small Tools: Machine Shop Practices" at a meeting of the Cincinnati chapter, A.S.S.T., Oct. 8.

WALTER H. GARDNER, formerly advertising manager of the Caterpillar Tractor Co., Peoria, Ill., has been appointed manager of the Specialty Sales Division, newly formed to market "Caterpillar" engines and sub-assemblies to other manufacturers. The full line of "Caterpillar" engines, both gas and Diesel, eventually will be adapted for the use of equipment manufacturers generally.

H. T. GILBERT, formerly assistant to the president of the Republic Steel Corp., and previous to that vice-president and general sales manager, has been appointed general manager of the Midland Steel Products Co., Cleveland.

M. J. GREGORY, factory manager, foundry division, Caterpillar Tractor Co., Peoria, Ill., addressed a group of one hundred foundrymen from the Quad City area and distant points at the Fort Armstrong Hotel, Rock Island, Ill., recently. His subject was "General Foundry Practice," illustrated by examples from the company's own plant. The importance of ideal working conditions were taken into consideration when the foundry was originally planned. The resulting modern foundry erected on made land permits the production of castings with a minimum of discomforting labor through the use of modern ventilating, heating and lighting equipment, as well as modern foundry units.

F. J. GRIFFITHS has been elected director and president of the Timken Steel & Tube Co., Canton, Ohio. M. T. LOTHROP, president of the Timken Roller Bearing Co., has been made chairman of the board of the Timken Steel & Tube Co. Mr. Griffiths has been connected with the steel industry for the past 30 years and until recently was president of the Republic Research Corp., a subsidiary of the Republic Steel Corp. Mr. Griffiths began his industrial career with the United Steel Co. at Canton, and later aided in the organization of the Central Steel Co., Massillon, Ohio, of which he was at one time president and general manager. When these two companies were merged to form the Central Alloy Steel Co., he was chosen chairman of the board, which office he held until the Central Alloy merger with Republic Steel.

DR. GEORGE B. KARELITZ, formerly manager of the mechanics division, Westinghouse Research Laboratory, East Pittsburgh, Pa., has been appointed division engineer in charge of transportation at the South Philadelphia works of the Westinghouse Electric & Mfg. Co. His duties will include supervision of the manufacture of marine apparatus, Diesel oil engines and other equipment. Dr. Karelitz came to the United States and joined Westinghouse in 1922. During the school year of 1930-31 he was on the engineering faculty at Columbia University, returning to Westinghouse last June. R. E. PETERSON, research engineer, has been named to succeed Dr. Karelitz as manager of the Mechanics Division of the Research Laboratories.

FRANK HUDSON, chief metallurgist and chemist of the Fordath Engineering Co., Ltd., Hamblet Works, West Bromwich, England, has resigned to join the staff of Glenfield & Kennedy, Ltd., Kilfarnock.

F. V. LARKIN, professor of Mechanical Engineering, head of the department, and director of the curricula in Mechanical Engineering and Industrial Engineering at Lehigh University, Bethlehem, Pa., has been granted sabbatical leave for the current year. He will make a world trip.

GEORGE H. MALONY has been elected secretary of Whitman & Barnes, Inc., Detroit, to succeed J. I. HOLTON, resigned.

PROF. RAYMOND ROARK, department of mechanics, University of Wisconsin, discussed the "Effects of Machining and of Surface Defects on the Strength of Cast Iron" at a joint meeting of the Wisconsin Gray Iron Foundry group and the department of metallurgy of the University of Wisconsin Oct. 14, at the Hotel Schroeder, Milwaukee.

RALPH N. ROBERTSON, until recently chief mechanical engineer for the Blaw-Knox Co., has become affiliated with the Atwood Bradshaw Co., Pittsburgh, Pa.

DAVID C. SLOANE has been appointed vice-president in charge of sales of the Wyrick Engineering Co., Wyandotte, Mich. He was formerly resident manager of the General Motors Acceptance Corporation.

H. A. WEBER, formerly assistant district sales manager in New York for the Weirton (W. Va.) Steel Co., has been appointed New York district sales manager, succeeding the late H. M. EASTON.

CHARLES H. WEHNER and SPENCER S. SWASEY have started a business in new and used machinery and equipment at 2142 Railway Exchange Bldg., St. Louis. They have previously been engaged for many years in machine tool and equipment sales, and will merchandise new and used machinery and equipment, locomotives, cars, cranes, shovels, hoists, turbines, motors, generators, compressors, Diesel oil engines, power plant machinery, tractors and other equipment.

OBITUARIES

WASHINGTON WARD BALKWILL, 82, steel foundry pioneer, died Oct. 4, in Willoughby, Ohio. In 1880 he formed a partnership with N. P. and WILLIAM BOWLER in the Bowler Foundry Co., and also helped organize in 1886 the Cleveland Frog Crossing Co., and the Standard Car Wheel Co. Six years later he organized the Cleveland Steel Casting Co., and was its president until his retirement in 1913.

SAMUEL JEFFREY COIT, 60, one of the most prominent machinists in eastern Connecticut, and an *American Machinist* reader most of his life, died Oct. 5 in Montville, Conn. He had been in poor health for the past two years.

BENJAMIN D. COPPAGE, 60, engineer and inventor, died of heart disease at Wilmington, Del., Oct. 6. He was designing engineer for the Viscose Co., at Marcushook, Del., at the time of his death and was the inventor of the criss-cross ball bearing, the plastometer and many other devices. For his invention of the plastometer, used for measuring the density of rubber, he was awarded the Franklin Institute Certificate of Merit. He began his career as an engineer with the Baldwin Locomotive Works, in Philadelphia, and had been associated with the Pusey & Jones Shipyard and the duPont interests in Wilmington.

ARTHUR MORGAN DODD, 47, general sales manager of the Horton Mfg. Co., washing machine manufacturer, Fort Wayne, Ind., died of heart disease recently.

EDWARD CHAPMAN FULLER, 78, retired director of the United States Cast Iron & Pipe Co., Columbus, died Oct. 4.

A. A. GRUBB, of Grubb & Marshall, consulting metallurgical engineers, Columbus, Ohio, died Sept. 29.

ROBERT D. PLATT, chief engineer of the Koppers Construction Co., Pittsburgh, died Sept. 27. He had joined the Koppers Co. in 1915 and had been appointed chief engineer in 1928.

WILLIS APPLEFORD SLATER, 64, research professor of engineering materials and director of the Fritz Engineering Laboratory at Lehigh University, Bethlehem, Pa., died suddenly there, Oct. 6, of complications, developing after an attack of tonsilitis.

RICHARD E. WARNER, 70, who founded the company that later became White-Warner & Co., Taunton, Mass., in 1883, died Oct. 1.

MEETINGS

NATIONAL SAFETY COUNCIL
Twentieth Annual Safety Congress, Chicago, Ill., Oct. 12-16. W. H. Cameron. Secretary, 20 North Wacker Drive, Chicago.

SOCIETY OF INDUSTRIAL ENGINEERS
Annual meeting, Pittsburgh, Pa., Oct. 14-16. George C. Dent, secretary, 205 W. Wacker Drive, Chicago, Ill.

GRAY IRON INSTITUTE
Fourth annual convention. West Baden Springs Hotel, West Baden Springs, Ind. Oct. 15-16. J. Arthur Tuscany, secretary, Terminal Tower Bldg., Cleveland.

AMERICAN GEAR MANUFACTURERS ASSOCIATION
Semi-Annual Meeting, William Penn Hotel, Pittsburgh, Pa., Oct. 15-17. T. W. Owen, secretary, 3608 Euclid Ave., Cleveland, Ohio.

STEEL FOUNDERS' SOCIETY OF AMERICA, INC.
New York meeting. Oct. 22. Granville P. Rogers, managing director, 932 Graybar Bldg., New York, N. Y.

AMERICAN IRON & STEEL INSTITUTE
Fortieth General Meeting, Hotel Commodore, New York, N. Y., Oct. 23. Headquarters, 75 West St., New York.

SOCIETY OF AUTOMOTIVE ENGINEERS
National transportation meeting, Washington, D. C., Oct. 27-29. John A. C. Warner, secretary, 29 W. 39th St., New York, N. Y.

AMERICAN MANAGEMENT ASSOCIATION
Industrial marketing conference, Hotel Statler, Cleveland, Ohio, Nov. 11-13 Headquarters, 20 Vesey St., New York.

INTERNATIONAL ACETYLENE ASSOCIATION
Thirty-second Annual Convention, Congress Hotel, Chicago, Nov. 11-13. Headquarters, 30 East 42nd St., New York.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS
Annual meeting, Engineering Societies Bldg., New York, N. Y., Nov. 30-Dec. 5. Calvin W. Rice, secretary, 29 West 39th St., New York, N. Y.

MACHINE REQUIREMENTS AND INDUSTRIAL CONSTRUCTION

Opportunities for Future Business

Calif., Alameda—Owens-Illinois Glass Co., W. I. Cole, Mgr., 133 Kearny St., San Francisco, is preparing plans for erection of a glass plant here. Estimated cost $1,000,000. Mills, Rhines, Bellman & Nordhoff, Inc., Ohio Bldg., Toledo, O., Engrs. Noted July 9.

Calif., Bay Point—Congoleum-Nairn, Inc., 195 Belgrave Dr., Kearny, N. J., is having preliminary studies made by Sanderson & Porter, 52 William St., New York, N. Y. Archts. and Engrs., for a plant for the manufacture of linoleum, felt base floor covering, etc., including power plant here. Estimated cost to exceed $1,000,000. Noted Sept. 3.

Calif., Los Angeles—Pennsylvania Iron & Steel Co., 2308 Santa Fe Ave., awarded contract for a 1 story, 72 x 145 ft. addition to shop.

Calif., Santa Ana—Pittsburg Plate Glass Co., Grant Bldg., Pittsburgh, Pa., awarded contract for the construction of a glass factory at Fairview and Bristol Sts. here. Estimated cost $4,000,000. Noted Dec. 11, 1930.

Conn., Bridgeport—White Line Bus Corp., 4490 Main St., completed plans for erection of a 1 story, 80 x 120 ft. bus terminal on Main St. Estimated cost $40,000. Leonard Asheim, 211 State St., Archt.

Ill., Peoria—Herman Body Co., 4420 Clayton St., St. Louis, Mo., plans the construction of a plant for the manufacture of truck bodies here.

Ind., Columbia City—Globe-Superior Co., awarded contract for erection of a 2 story, 80 x 200 ft. factory. Estimated cost $45,000. Noted October 1.

Ia., Council Bluffs—Chicago Great Western R.R. Co., Grand Central Station, Chicago, Ill., awarded contract for addition to roundhouse here. Estimated cost $20,000. C. G. Delo, Chicago, Ch. Engr.

Ia., Sidney—Iowa State Highway Commission, Ames, L. M. Martin, District Engineer, Council Bluffs, awarded contract for the construction of a 1 story maintenance garage at District No. 4 here. Noted Sept. 10.

Mass., Lawrence—Able Bros., c/o J. G. Morisette, 575 Essex St., Archt., completed plans for addition and alterations to service garage on Jordan St. Estimated cost $40,000.

Mass., Lowell—Lowell Electric Light Corp., J. A. Hunnewell, Pres., will soon award contract for the construction of a 1 and 2 story service building and garage on Perry St. Estimated cost $100,000. New England Power Association, 89 Broad St., Boston, Engrs., in charge of construction work.

Mass., Medford—Boston Elevated Railway Co., 31 St. James Ave., Boston, awarded contract for superstructure of a 1 story, 65 x 155 and 30 x 35 ft. bus garage at Felsway West and Salem Sts. Estimated cost $50,000. Noted October 1.

Mich., Detroit—Square D. Co., 6060 Rivard St., manufacturers of electrical safety devices, awarded contract for a 1 story addition to plant. Estimated cost $40,000.

Minn., Minneapolis—Board of Education, G. F. Womrath, Bus. Supt., 305 City Hall, awarded contract for the construction of first unit of vocational school at Third Ave. S. and Eleventh St. $389,599. Estimated total cost $700,000. Noted Sept. 10.

Minn., Minneapolis—City, F. S. Gram, Purch. Agt., 223 City Hall, completed plans for a 1 story, 66 x 116 ft. warehouse and repair shop at Third St. S., between Second and Third Aves. Estimated cost $35,000 to $40,000. A. M. Larson, c/o City Engineers Dept., Architectural Engr. Noted Oct. 8.

N. H., New Durham—Allen Manufacturing Co., plans to rebuild enamel factory recently destroyed by fire. Loss $25,000 to $40,000.

N. J., Raritan—H. Bulkin, North Bridge St., Somerville, is receiving bids for the construction of a 1 story, 60 x 150 ft. factory here. Estimated cost $40,000. P. C. Van Nuys, 1 West Main St., Somerville, Archt.

N. Y., Brooklyn—Reid Ice Cream Corp., 542 Waverly Ave., plans a 1 story, 95 x 99 ft. service garage at Waverly Ave. and Fulton St. Estimated cost $40,000. J. E. Ross, 25 West 43rd St., New York, Archt.

N. Y., Elmhurst—J. C. Trumpfeller & Sons, 47th Ave. and Queens Blvd., plans the construction of a 2 story, 38 x 65 ft. service garage and factory. Estimated cost $40,000. C. Hendry, 8304 Baxter St., Jackson Heights, Archt.

N. Y., New York—Paul Sowada, 369 Palmer Ave., Yonkers, (light manufacturing) plans the construction of a 2 story, 44 x 103 ft. factory at 239th St. and Bullard Ave., here. Estimated cost $40,000. Edward Gower, 135 Fortfield Ave., Yonkers, Archt.

N. Y., Ozone Park—S. LoPiccolo, 301 Covert St., Brooklyn, will build a 1 story, 100 x 164 ft. service garage at Atlantic Ave. and 102nd St. Estimated cost to exceed $40,000. Charles Cannella, 1163 Herkimer St., Brooklyn, Archt. Work will be done by separate contracts. Noted October 1.

N. Y., Queens Village—Queens Carmel Gardens, Inc., 250 Crown St., Brooklyn, plans the construction of a 1 story, 164 x 237 ft. service garage and stores building at 222nd St. and Jamaica Ave. here. Estimated cost $60,000. B. Braunstein, 163-18 Jamaica Ave., Jamaica, Archt.

N. Y., Woodhaven—Anheuser Busch, Inc., 979 Brook Ave., New York, awarded contract for alterations to plant and garage at 104th St., Atlantic Ave. and 94th St., here. Estimated cost to exceed $40,000.

O., Bascom—Gem Manufacturing Co., plans the construction of a 1 story, 40 x 180 ft. factory for the manufacture of wooden toys. Estimated cost $40,000. Private plans.

O., Cleveland—Greyhound Management Co., Orville L. Caesar, Pres., 1783 East 11th St., plans a 1 story, 100 x 500 ft. garage building. Estimated cost $200,000. Ralph Cummins, c/o owner, Archt.

O., Galion—Gledhill Road Machinery Co., E. C. Gledhill, Pres., awarded contract for a 1 story, 90 x 220 ft. factory. Estimated cost $50,000. Noted August 20.

O., Youngstown—Automatic Industries, Inc., 49 South Forest St., awarded contract for a 1 story addition to factory for the manufacture of mechanical equipment.

Pa., Beaver Falls—Mayer China Co., plans to rebuild factory and office building destroyed by fire. Carlisle & Sharrer, Martin Bldg., N. S., Pittsburgh, Archts.

Pa., Johnstown—Standard Oil Co. of Pennsylvania, W. E. Black, in charge Peoples Gas Bldg., Pittsburgh, awarded contract for the construction of a bulk oil plant including 1 story 32 x 89 ft. garage and office building, 1 story, 50 x 100 ft. warehouse, 14 x 16 ft. metal pump house, etc., at Krings Station, here.

Pa., Philadelphia—Prison Board, City Hall, awarded contract for the construction of a cell building, including mechanical shop, etc. Estimated cost $260,000.

Tenn., Memphis—Vulcan Iron Works, 138 East Butler St., plans to rebuild shop recently destroyed by fire. Loss $20,000.

Tex., Smithville—Smithville Lumber Co., H. R. Hope, will build sawmill, 30,000 ft. capacity. Work will be done by owners forces.

Utah, Salt Lake City—Lauren W. Gibbs, c/o American Thrift Corp., will soon award contract for a 1 story bus garage. Estimated cost $40,000. Young & Hansen, McCormick Bldg., Archts.

Equipment Wanted

Ga., Savannah—C. H. Herty,. 101 Park Ave., New York, N. Y., Engr., is receiving bids for machinery and equipment for pulp and paper mill for State Department of Forestry & Geological Development, Capitol Bldg., Atlanta.

N. Y., New York—Peter J. Dooling, Commissioner of Purchase, Municipal Bldg., will receive bids until Oct. 19 for shaper and lathe for Departments of Parks, Manhattan and Queens Boroughs.

Mich., Detroit—Department of Street Railways, St. Jean and Shoemaker Aves.—vertical boring mill, pipe threading machine, power feed rip saw and mitre saw.

O., Cleveland—J. Soos Ornamental Iron Works, 3935 Cedar Ave., 14-15 in. lathe and punch presses.

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